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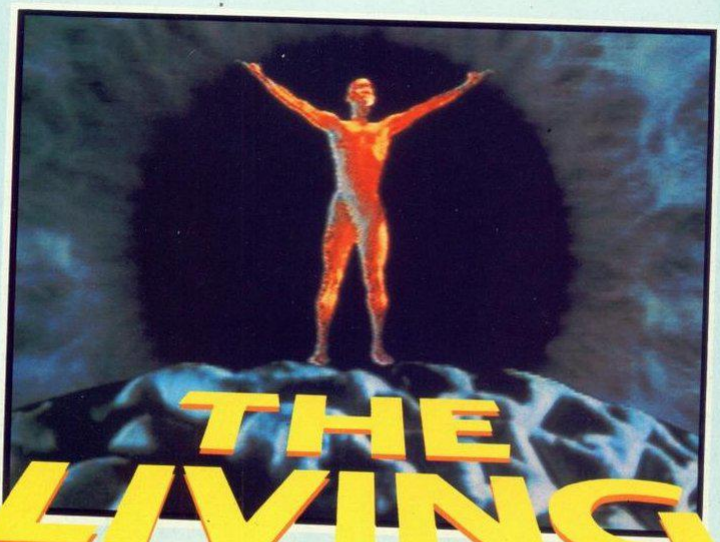

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48K SPECTRUM · COMMODORE 64 · BBC 'B' · ELECTRON

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MAY 1985

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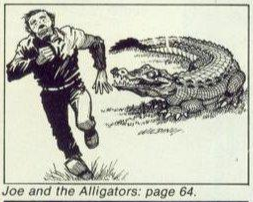
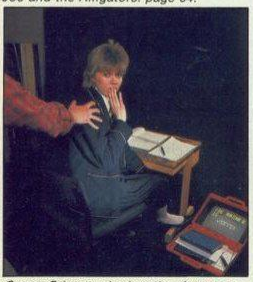

Joe and the Alligators: page 64.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66 **BBC TANKS:** Nick Sheard puts something nasty in your briar patch. An armoured division. Time to get the old Sherman out of the garage. Tanks for the memory.

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72 **ZX SPECTRUM SNAKES ALIVE:** A 100 percent machine-code game for any Spectrum. Kahn the snake has to collect nine eggs. 48 locations and joystick option.

78 **ZX-81 SURVIVOR:** Adrian Spriddell's condensed version of the ZX-81 graphic adventure game Survivor. Contains 10 of the original levels.

83 **AMSTRAD JUMPER:** An arcade quality game for the Amstrad CPC-64 in which you guide a little man called Jumper to the top of the screen. By Jason Charlesworth.

86 **TELSOFT:** This month we extend the Telsoft service to Commodore 64 owners. On Telsoft this month are Toolkit, Compiler and Space Junk.

90 **ZX SPECTRUM TOOLKIT:** User-friendly Dave Spagnol brings you a really useful toolkit which avoids single key entry and default values.

94 **BBC COMPILER:** Suitable for use on the Electron as well, describes a compiler which enables programs to run five times faster.

99 **QL ZOOM:** Software-based magnifying glass by Carsten Greave.

102 **QL PLOTLINE:** Mark Jones draws a better box.

104 **CONSUMERS' GUIDE TO DATABASES:** John Dawson accesses some useful sources of information on his BBC.

109 **COMMODORE CBM-64 REPEAT UNTIL:** M C Hart shows you how to nest loops to a theoretical limit of 22 deep.

111 **COMMODORE CBM-64 TRAX DISC EDITOR:** Keith Suddick shows you how to avoid the trauma of your 1541 disc drive turning work into garbage.

114 **CBM-64 SPACE JUNK:** Nalin Sharma is lost in space.

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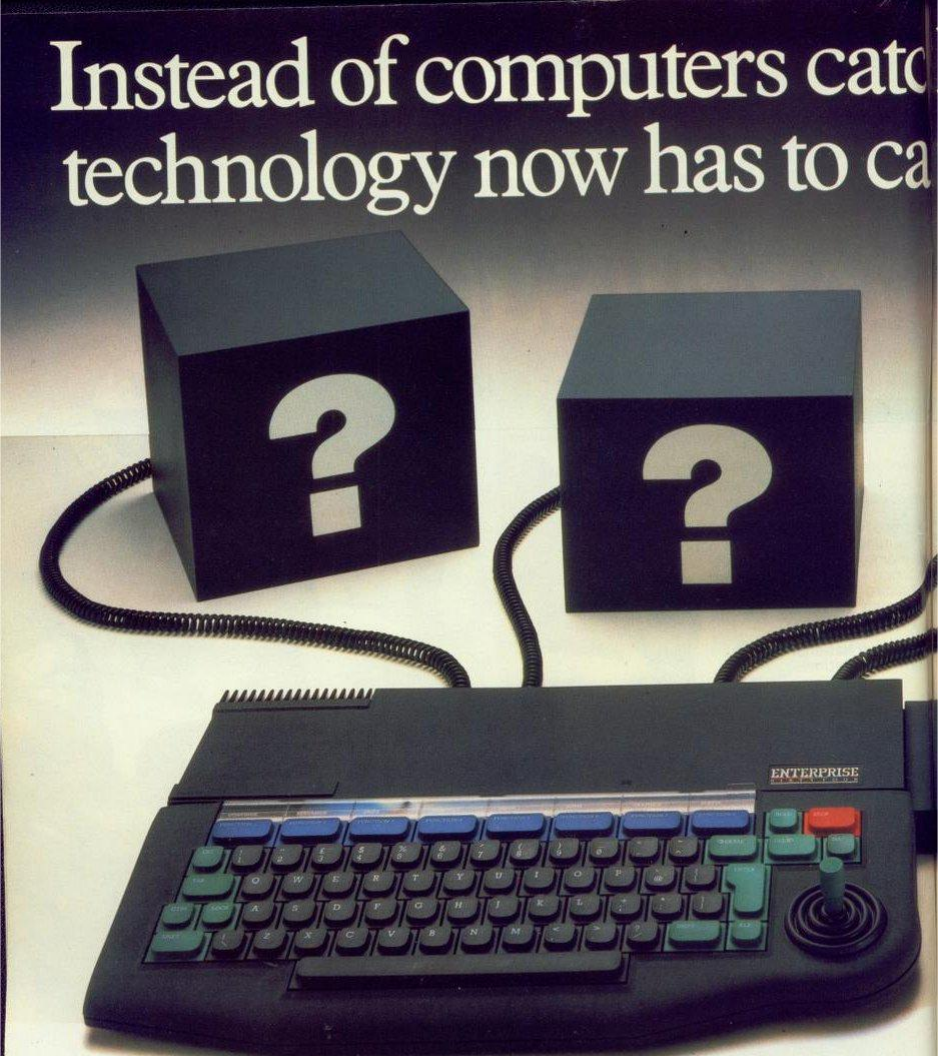

The way we see it, technology has suddenly got quite a race on its hands.

There's no other home computer in the world that's so expandable or so updatable as the new Enterprise 64.

And if you're wondering quite how we've managed that, kindly take a closer look at the outputs on our remarkable new machine.

You'll notice that amongst all the usual sockets and terminals, we've gone and incorporated a special 66-way expansion port.

This will accept a whole range of new peripherals that are in the pipeline. Including those that are a mere twinkle in the eyes of our hardware designers.

We thought this expandability principle was such a good idea, we applied it to the Enterprise's memory, too.

Even in its most basic 64K form, this puts more user RAM at your disposal than almost any other competitor.

But plug in our special Rampacks to the base unit, and you can progressively increase that figure to a truly extraordinary 3,900K.

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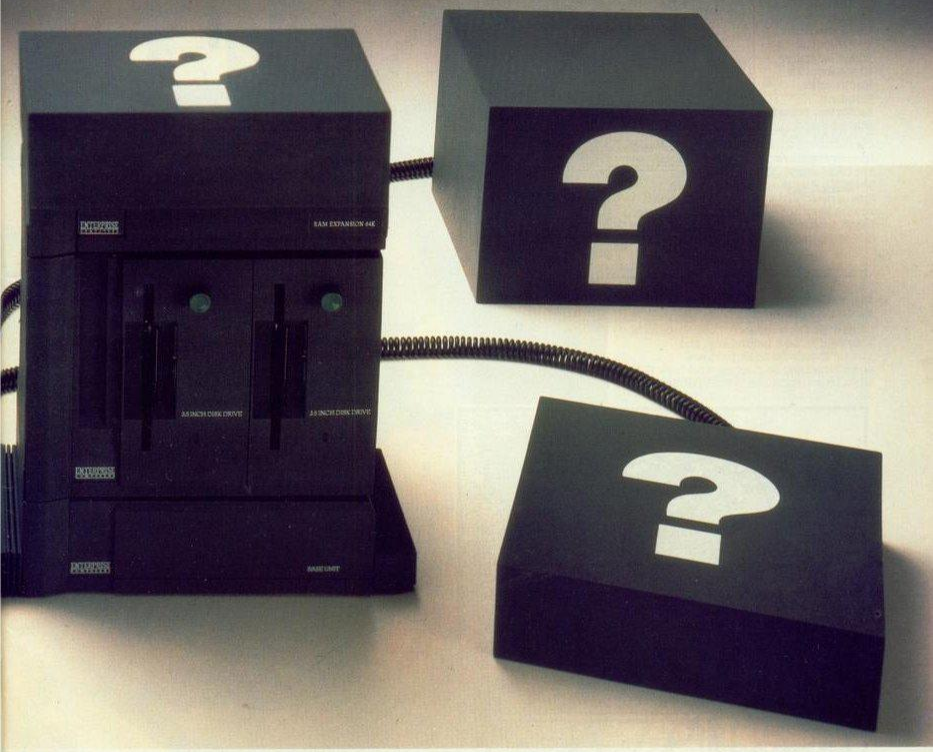

Not that that's the only challenge we present to today's ambitious programmers.

With a screen resolution of up to 672 x 512 pixels, 256 colours and a high speed video processor, the Enterprise will outgun all but the highest quality TV monitors.

And the sophisticated sound chip generates no fewer than 4 voices across 8 octaves in full stereo.

Combine the two and you can create effects that leave today's games looking like pub video tennis of the mid-seventies.

For anyone with literary aspirations, the Enterprise also comes complete with an integrated word processor.

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The new Enterprise 64.

It hasn't just overtaken technology. It's left every other home computer straggling in the distance.

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At 21.15 hours on the evening of May 16th 1943 a flight of specially prepared Lancaster bombers left Scampton Airfield for Germany. After months of planning and preparation Wing Commander Guy Gibson and his 617 Squadron were at last embarking on a mission so daring that it would guarantee them a place in the annals of history.

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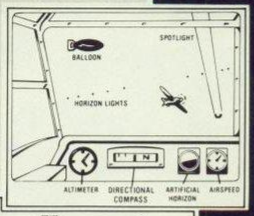
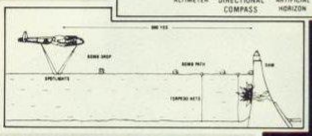
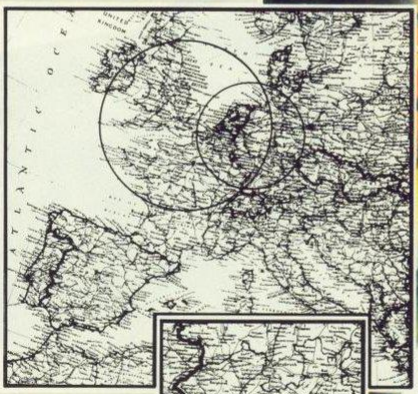




bring the important Mittelland Canal to a virtual standstill.

Of course the successful conclusion of this raid is now legendary, the young men who took part are acknowledged as heroes; and now U.S. Gold in conjunction with Sydney



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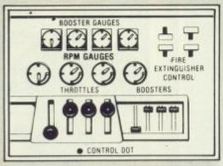

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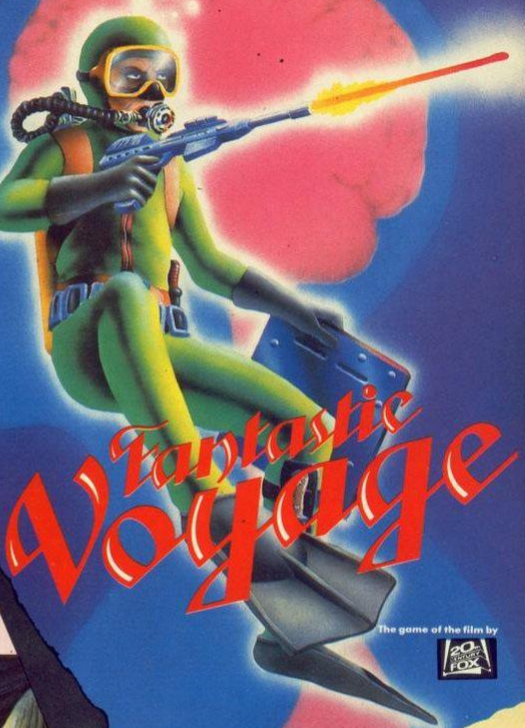

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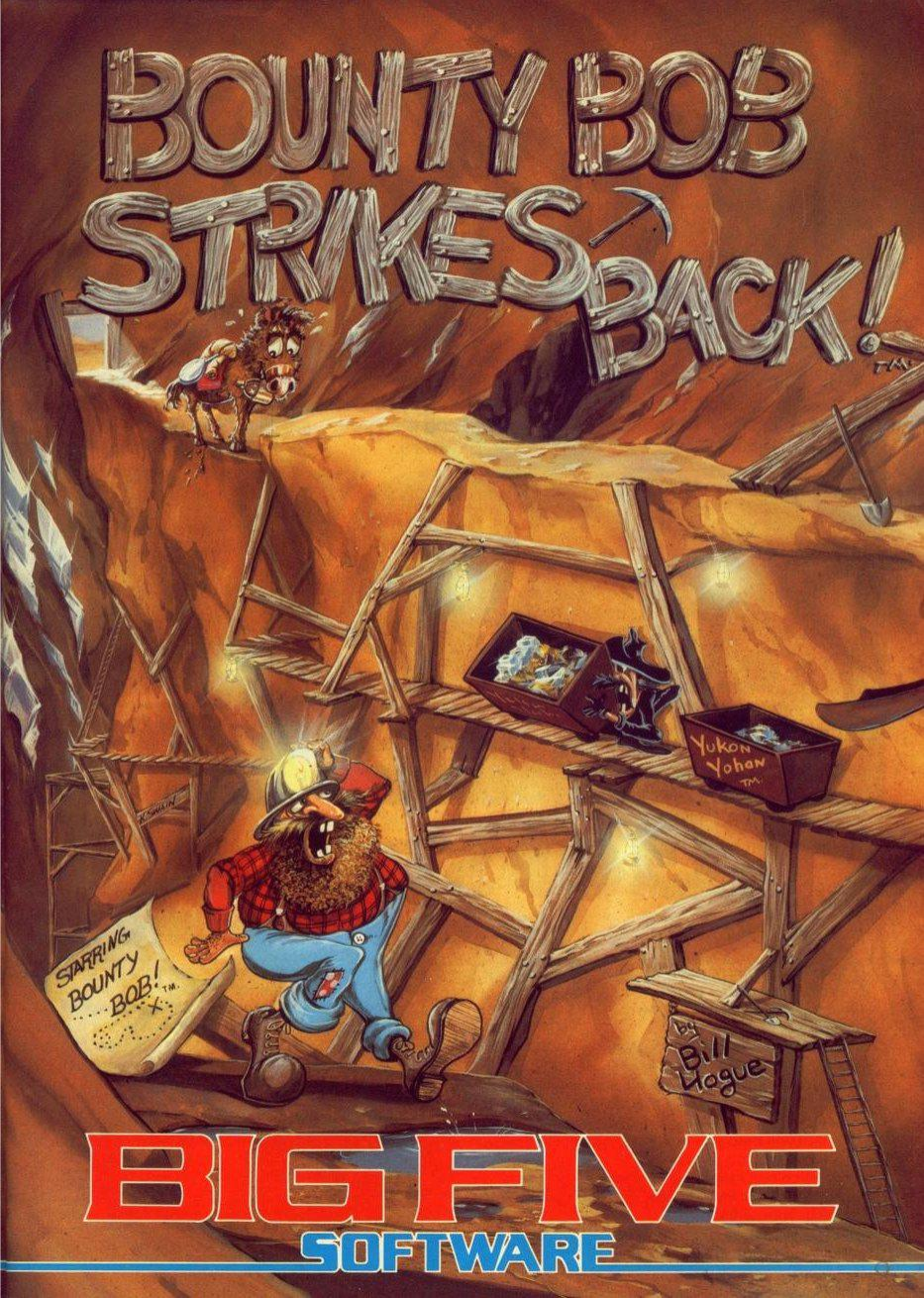

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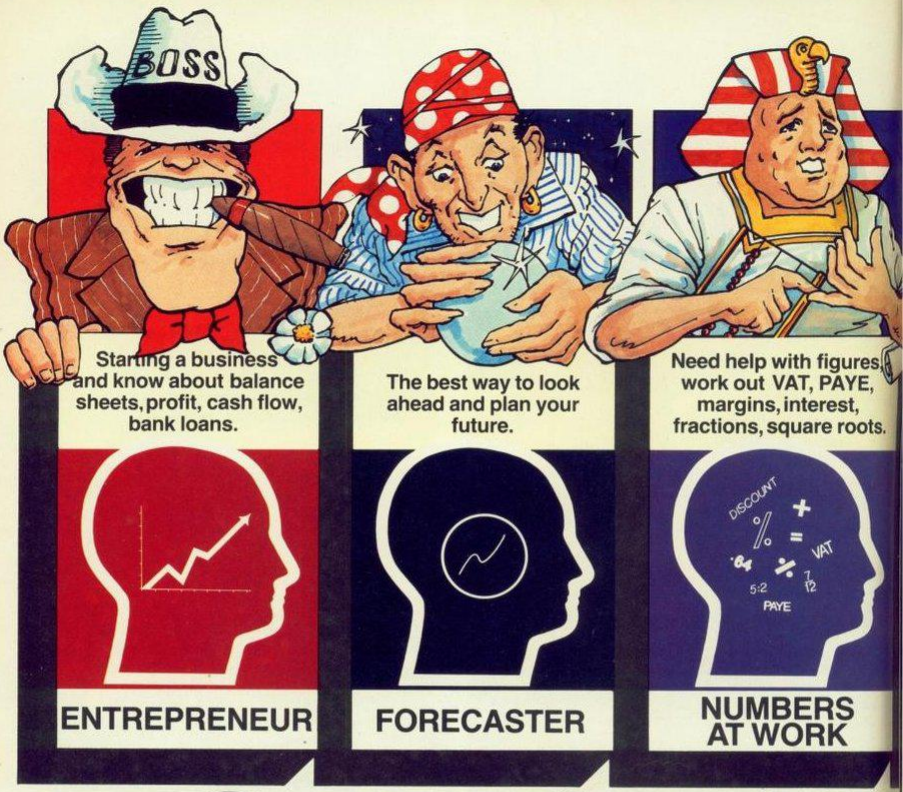

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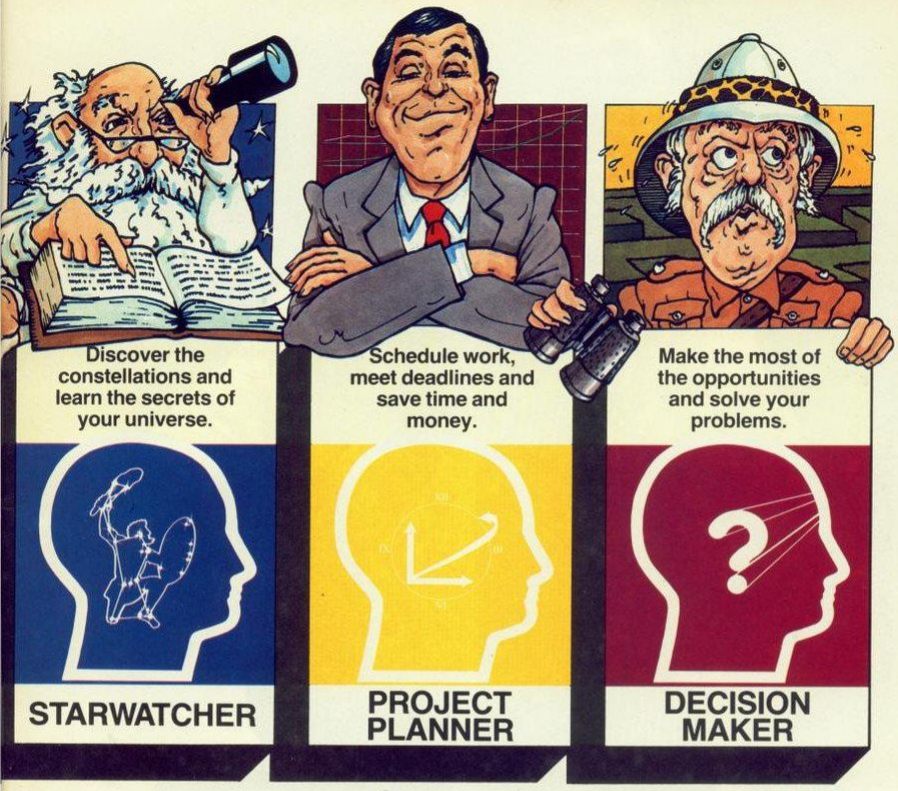

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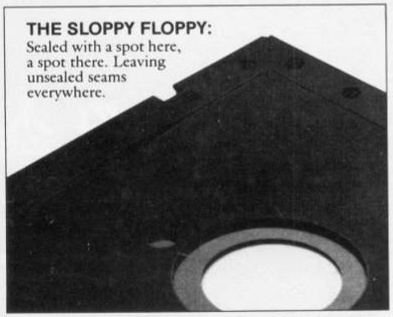

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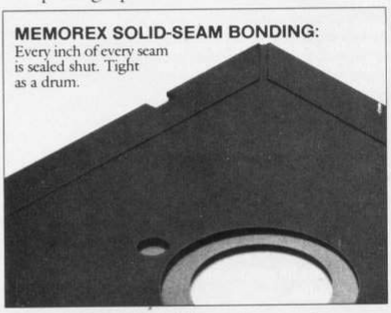

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Quasi knows a secret! Quasi knows where the jewels have been hidden in the castle and only Quasi can climb there.

They better leave Quasi alone, 'cause Quasi is getting mad. Quasi better hurry and find the jewels. Not much time. Quasi sees lots of soldiers. Quasi has lots of rocks.

Now the noise has stirred up the bats in the belfry. The bats are mean, they make Quasi fall down. Quasi better jump away from those bats.

Quasi thinks he got up on the wrong side of the bed today.

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SILICON BOBBIES FLEX THEIR KNEES

AS TV SETS BLARE out the British Telecom "It's for you-hoo" ad slogan, hackers quite clearly only get interested when it isn't.

Breaking into unauthorised pages or parts of computers is their idea of having a good time. And although these electronic trespassers might agree that what they do is wrong, they would argue that it's really only good clean fun.

Comparisons with the early, illegal days of CB radio may seem inevitable — doing something you shouldn't — but with little risk of being caught. Yet whereas citizens' band eventually became legal, there is little chance of hacking becoming so. On the contrary, recent events show that the authorities are clamping down. The arrest of two hackers in London may be a taste of what is to come.

Armed with only a home computer, modem and telephone, hackers see their hobby as a test of ingenuity: the authorities see it as a challenge to security.

The current flood of hacking stories may be seen as bad publicity for the likes of Prestel but surely they could equally be welcomed for pointing out glaring deficiencies in system security.

After all, because networks like Prestel offer some subscribers a promise of confidentiality and are under obligation to make their system secure, it must be better that if security is to be breached it is done by people for fun rather than by vandals or criminals for financial gain.

Some claim that it is not unknown for a new network to release passwords to the hacking fraternity to test out its ability to react to breaches in safeguards. Hackers aren't interested in making use of information once they have gained access to it. They might occasionally leave a calling card by, for example, changing a letter in an unimportant word just to say they have visited.

Perhaps the recent spate of publicity surrounding hacking could actually help telecomms in general by encouraging home computer owners to buy modems. There are plenty of legitimate applications around such as *Your Computer's* Telsoft service, Prestel and Micronet 800. It seems sad that at a time when interest in modems is increasing, one of Britain's main home computer modem manufacturers, OEL, has gone into receivership. The good news is that you can still pick up one of its modems for around £40.

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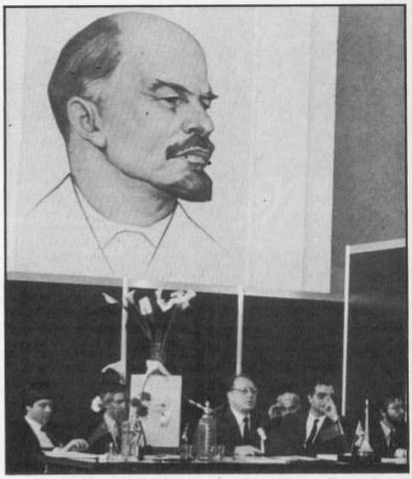

Memotech negotiates in Moscow.

KREMLIN 'N CHIPS

RUSSIA needs one million micros in its schools to fulfil the next Five Year Plan and British companies are queueing up to offer their products.

Surprise front runner at the moment is Memotech backed by the Spectrum Group USSR Consortium headed by Dudley Langmead. Memotech has already produced a full Cyrillic keyboard and Rom for its MTX range but since Gorbachev came to power the pace has quickened and last month Langmead, together with Branton and Tupper from Memotech, met Soviet officials in Moscow.

The USSR might import the first 50,000 computers ready-built then switch to components and eventually self-production in a deal worth £100 million a year.

But Acorn and Sinclair are not out of the hunt — with Sinclair claiming that 100,000 Spectrums have already been unofficially exported to Eastern Europe.

Wrist micro

SEIKO'S new computer terminal in a wristwatch is the ultimate gimmick. Just plug it in to your Commodore 64 and it can receive 2K of data which can then be displayed over 80 "pages" of its two-line 24-character LCD display.

If you must use the £120 RC-1000 as a mere wristwatch you can still plug it in to your CBM-64 and use the big TV screen to set up messages which can be timed to appear at any time over the next year on your watch to remind you of birthdays and anniversaries.

Ultimate gimmick

TIME FOR 128K

Commodore sorts chaos

Commodore going to any lengths to dispose of surplus stock.

AMSTRAD, Enterprise and Commodore are launching their new 128K computers into the middle of a price war caused by the low Christmas sales which have left half a million lower specification machines still clogging up the warehouses.

Amstrad's CPC-664 will resemble the 464 except for the extra memory and built-in disc drive to replace the tape. Like the Commodore 128 it will be able to run CP/M programs although the CBM-128 "Shotgun" will also be CBM-64 compatible.

Its lack of compatibility with the C-16 and Plus-4 range probably means that the writing is on the wall for the two most recently introduced Commodores which are already being heavily discounted.

No wonder Commodore U.K. is recruiting an IBM executive as General Manager to try to sort things out.

BODY SYSTEMS AS ENTERTAINMENT

"THE THING about computers is that they lack intentionality. Essentially, they don't *want* to do anything — they're happy to follow orders." After two years' break from theatrical work, it is clear that Dr Miller is bubbling with ideas generated by study at the University of Surrey concerning artificial intelligence, and is almost more keen on discussing this than Bodyworks — the computurised follow-up to his pop-up book *The Human Body*.

Dr Miller first rose to prominence as part of the *60s* revue Beyond the Fringe which spawned such stars as Peter Cooke, Dudley Moore and playwright Alan Bennett. Apart from his work directing opera and stage plays, he more recently conducted a guided tour of the human body in BBC TV's The Body In Question.

Miller's body works

Together with the directors of the production company, Genesis, Jonathan Miller believes that there is a gap between serious business or educational software and games. Bodywork reviewed in this month's Software Shortlist is the first in a series of programs intended to fill this gap.

Genesis' future projects include a pop-up book and probably a computer game designed in co-operation with the Natural History Museum, London. And for Dr Miller? "I'd like to do a program devoted entirely to memory.

As a doctor how does he feel about the use of computers in hospitals? "Quite good in certain respects — diagnostic machines are less forgetful, but they have no intuition. Attempts to use them in psychoanalysis, as happened with Weizenbaum's Eliza program, are a reflection of the impoverishment of our lives."

How to fast load hits on a Spectrum

ALL THAT tedious messing about with assemblers is a thing of the past with the Transformer, a utility from Soft Machine, guaranteed a farm welcome from FAST — or possibly a writ.

This utility contains specific routines for copying 30 of the most recent blockbusters, including the chart-topping Alien 8 and Cyclne. Adding insult to injury, it even copies them to Microdrive, leaving out such space-wasters as loading screens. So legitimate back-ups can be made of your own software!

Wafadrive speeds up CBM-64

THIRTY SECONDS to load any program on a Commodore sounds too good to be true, but that's the claim for the new £99.95 Quick Data Drive. That compares well with cassettes which take anything up to a quarter of an hour, and even the 1541 disc drive's take two minutes.

The drive, from Dean Electronics for the CBM-64 or Vic, plugs into the cassette port. Once the system is booted up by pressing Shift/Run, you have the usual Load, Save, and data storage commands. There is also a System file which gives directory, formatting and copying commands. The drive uses the same technology as the Rotronics Wafadrive.

Clive C5 on screen

WHILE gearbox problems halt production of the real C5 tricycle, Scorpio Gamesworld has cashed in with a C5 Clive Spectrum arcade game.

You have to keep picking up batteries if you want to keep going through 50 screens of hazards between the shop and your home.

Link to Giant Mainframes and network to thousands of Micro users via your 'phone with free Modems and Comms software in the British Telecom Modem competition.

British Telecom is offering 1000 free gift packs to plug direct into your home 'phone line.

British TELECOM

MODEM COMPETITION

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For the 5 questions 'phone
01-627 3000 or
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To get the Tiebreaker Sentence 'phone
01-627 1199 or
0532 455030 or
0632 324444

Complete the entry form using your skill and judgement, and send it off in the next post.

RULES OF THE BRITISH TELECOM MODEM COMPETITION

1) The dial-in is available from 6pm Monday 22nd April to midnight Sunday 5th May 1985, when the competition closes.
2) Entries must be postmarked the next working day after the questions and tiebreaker were obtained.
3) Entries can only be made on the official entry forms and become the property of British Telecommunications plc.
4) The competition is open only to residents of the United Kingdom over the age of 18 years. Employees of the Network Marketing Unit of British Telecommunications plc and PARKER REDMILE LTD. and their dependants are excluded. Only one winning entry per household.
5) Entries not reaching the competition address before midnight on Thursday 9th May 1985 will not be considered.
6) A list of winners will be provided at the competition address. Please send an SAE if you wish to receive it.
7) The winners will be picked as follows from entries received on time and properly completed –
The entries for each type of prize pack with all correct answers to the 5 questions and with the tiebreaker sentences judged most apt and humorous by the competition organisers will be chosen, subject to the stock of appropriate prize packs.
8) The decision of the competition organisers is final and no correspondence will be entered into. Winners will be notified automatically.
9) British Telecommunications plc offers winners requesting BT 'phone socket conversion on entry forms to waive the charge normally made for such work.
10) Details of how to get on Prestel/Micronet 800/Telecom Gold will be sent to winners. Subscriptions not included in prize.

OFFICIAL ENTRY FORM

A. Your answers:
Q 1 .....
Q 2 .....
Q 3 .....
Q 4 .....
Q 5 .....

B. Tiebreaker Sentence complete (25 words or less in total):
" .....
.....
..... "

C. If I win, I would like the prize pack for the
■ SPECTRUM/SPECTRUM +
☐ BBC MODEL B (Tick Choice)
☐ COMMODORE 64

D. My home telephone line (* Delete as appropriate)
(a) already has a square-type BT 'phone socket * or
(b) would need converting to square-type BT 'phone socket *
If (b), the person renting the line from British Telecom must fill in this declaration –
If this is a winning entry, I agree to ask British Telecom to convert my line to square-type BT 'phone socket at a convenient date before 1st July 1985. My line is on Residential rental, is not a coinbox and is not shared service.
I understand British Telecom will not charge for doing the work.

Name ..... (Block Capitals)
Telephone number .....
Signature .....
Date 1985

E. I have read the rules of the British Telecom Modem competition and agree to abide by them. I am over 18 years old.

Signature of entrant .....
Date 1985
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..... Postcode .....

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What's my line?

Hacking charges against Mouse

STEVE GOLD, otherwise known as Micronet's Micromouse, and Robert Schifreen, a freelance journalist, were arrested on Wednesday night, 27th March.

The two men were taken to Holborn Police Station, where they were charged the following morning with offences under the Forgery and Counterfeiting Act 1981. A Scotland Yard spokesman said that this was "the first ever police operation in this country into the alleged use of computers to interfere with other computers". He said, "Officers from the Computer Crime Unit of the Metropolitan and City Fraud Squad in an operation in the Edgware area of London and the Crosspool area of Sheffield arrested the two men.

The raids were made in co-operation with the British Telecom officials and South Yorkshire Constabulary, under a warrant issued under section 7 of the Forgery and Counterfeit Act of 1981. They follow a three month operation into the alleged interference with the Prestel system and warnings from police that publications such as *The Hacker's Handbook* might incite people to break the law.

Century, the Handbook's publishers, has denied that either of the men charged is connected with the Handbook and the police admit that the arrests had no connection with the *Hacker's Handbook*, but they are still investigating it.

The charge the two men face is that they "forged an instrument, namely an electronic device, for recording information on the Prestel Gateway and the Kipling, Dickens and Keats Prestel computer, contrary to section 1 of the Counterfeit and Forgery Act 1981".

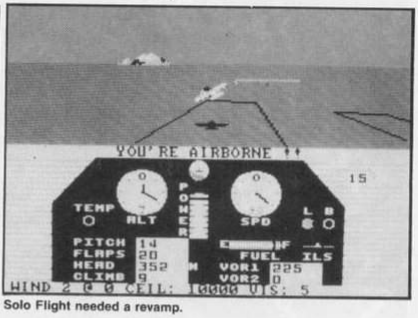
RIGHT STUFF

Pilot's Kennedy Approach

"I'M SELLING these games to men. If you haven't got the right stuff, I don't want to know." rasps Bill Stealey, president of MicroProse Software. Home of such hits as F-15 Strike Eagle, Nato Commander and Solo Flight, MicroProse programs are currently available in this country under the US Gold banner.

The next phase of ex-fighter pilot Bill's assault on the British software market via the US Gold beach-head has three main components: the Command series of Eastern Front style war games; a re-vamped version of Solo Flight and a remarkable air traffic control simulation called Kennedy Approach.

The Command series simulations allow you to play against the computer or against another player, The first two games available in the UK feature multiple scenarios ranging from single missions to in-depth campaigns. Crusade in Europe puts you in command of the Allied or German forces in Europe from D-Day to the Battle of the Bulge, and Decision in the Desert allows you to be either Monty or the Desert Fox in North Africa from 1940 to 1942. Both games have a 10-screen scrolling map, strategic maps, game save and a flashback function.



Solo Flight needed a revamp.

Air traffic controllers are one of the sectors of the American public most prone to heart attacks. You can now expose yourself to this threat in the comfort of your own home with Kennedy Approach — students of American labour relations will be disappointed to know there is no strike option in the £14.95 game. But it features excellent synthesised speech — right down to the blast of static that you always hear in the movies when the pilot replies to the tower.

US Gold plans to market the Command series at £20 — a stiff price? "I'm not interested in the kind of guy who just wants a short thrill," says Bill Stealey." If you want to spend £6 on an arcade game that you're going to play for an hour, I don't want you buying my software."

PSION EYES MARKS CARD

PSION'S ORGANISER is now helping Marks and Spencer fight Chargecard frauds quickly and conveniently.

The Organiser enables assistants to validate a card on the spot without the usual time delay in getting telephone confirmation from the central office. The Eprom datapak is loaded with the latest list of invalid cards and distributed to the stores overnight, making stolen cards virtually worthless within 24 hours of being reported lost.

Other Organiser applications include the Wessex computerised on-site building estimates system, and a prescribed drug calculator, giving a dosage, precautions to be taken and side effects of 280 commonly used drugs. Entering the symptoms produces a list of recommended drugs.

Wessex hard hat

New Gen Jonah and the wail

CLOSE YOUR eyes and you could be playing squash at the highest level — although you might miss the ball. New Generation's talking squash for the Spectrum uses a synthesised version of Jonah Barrington's voice to read out the scores.

Interface clocks on

IF YOU HAVE an Electron with a Plus 1, Cumana's new disc interface plugs straight into the cartridge port. The interface contains a battery-backed real-time clock for date stamping.

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POP★TOPS

TOP 20

	Game	Company	Machine
	1 Booty	Firebird	Sp
*	2 Everyones a Wally	Microgen	Sp
	3 Starstrike	Real Time	Sp
	4 Match Day	Ocean	Sp
*	5 Alien 8	Ultimate	Sp
	6 Ghostbusters	Activision	Sp
	7 Wild Bunch	Firebird	Sp
*	8 Monkey Magic	Solar	16
*	9 Broad Street	Argus	64
	10 Skool Daze	Microsphere	Sp
	11 Airwulf	Elite	Sp
	12 Blackbusters	Macsen	Sp
	13 Overdrive	Superior	El
	14 Technician Ted	Hewson	Sp
*	15 3D Time Trek	Anirog	16
	16 Go Go Ghost	Firebird	64
*	17 Byte Bitten	Firebird	Sp
*	18 Dukes of Hazzard	Elite	Sp
*	19 Mini Office	CDS	Sp
*	20 Bumper Bundle	Alligator	El

Sp = Spectrum/Bc = BBC/16 = C16
El = Electron/Vc = Vic-20
Dr = Dragon/64 = CBM 64
Am = Amstrad/Or = Oric/At = Atari
* = New release/— = Same position
Source: WH SMITH

TOP 3 BY MACHINE

		Game	Company	Machine
*	1	Vegas Jackpot	M. Tronic	Vc
—	2	Punchy	Mr Micro	Vc
—	3	Duck Shoot	M. Tronic	Vc
*	1	Mega Hits	Beau Jolly	64
*	2	Chiller	M. Tronic	64
*	3	BMX Racers	M. Tronic	64
	1	Bruce Lee	US Gold	Sp
	2	Raid over Moscow	US Gold	Sp
	3	Wizards Lair	Bubble Bus	Sp
	1	Hunchback	Ocean	Dr
	2	Manic Miner	S. Projects	Dr
	3	Dragon Chess	Oasis	Dr
—	1	Snooker	Visions	Bc
	2	Mini Office	Database Pub.	Bc
—	3	Castle Quest	Micropower	Bc
—	1	Compilation Tape 1	English	At
	2	Colossus Chess	English	At
	3	F15/Strike Eagle	Centresoft	At
—	1	Williamsburg Adv.	Microdeal	16
	2	Roller Kong	Melbourne House	16
—	3	Stellar War/ Blitz	CBM	16
	1	Classis Adventure	Melbourne House	El
—	2	Mini Office	Database	El
	3	Overdrive	Superior	El
—	1	Mutant Monty	Amsoft	Am
	2	Sorcery	Virgin	Am
—	3	Mini Office	Database	Am

Source = Websters Software

YOUR Letters

CONGRATULATIONS

IT IS ONLY on a very few occasions can I recall seeing in your columns letters from readers who have felt compelled to tell us of retailers who have performed a "service beyond the call of duty". We are so used to reading of late deliveries, damaged goods and exaggerated descriptions that we are flabbergasted when we encounter that almost extinct species, the "caring" supplier.

It is with real pride, therefore, that I bring to the notice of *Your Computer* readers Dr. Andrew Wright of Betasoft whose software application for the 48K Spectrum, Beta Basic, adds 30 extra commands and a further 20 functions in just 11K of code.

I recently bought a Rotronics Wafadrive for my Spectrum and discovered that because of overwritten addresses the drive was not compatible with Beta Basic. I wrote to Betasoft for assistance and, to my utter amazement, almost by return of post I received a reply from Dr. Wright advising me that the necessary modification was in hand and, upon satisfactory trials, I would be sent a copy.

Now, only a few weeks later, I have up and running a Wafa-based version of Beta Basic which, incidentally, has been upgraded to take better advantage of the drive and printer output facilities.

Peter Marles,
Leeds,
West Yorkshire.

NUKE LEAR

DO YOU KNOW Nuke Lear from CCS? It's the best buy on the market! Why?

- It costs only £2.99!
- It is the only game that can be enjoyed by beginners and experts alike! Levels 1 and 2 are for kids, levels 3-7 are hard enough for the best shoot-'em-up champions, levels 8 and 9 will never be finished evey by the best!
- You get a free compiler with it! Just load it by typing

CLEAR 39999: LOAD "W"
CODE 59900,5636

Then type in or load your Basic program. Type Randomise USR 60000 to compile it, Randomise USR 40000 (=start-address) to run the compiled version.

It will run 20-100 times faster than the Basic version.

H. Schneider,
Hamburg,
West Germany.

GOOD HACKERS

I READ WITH interest your first bytes feature in the April 1985 issue of *Your Computer*. May I first make it quite clear that I am in agreement with everything you say about the modern day hackers, people who seem to delight in attempting to sabotage the efforts of serious DP users.

What I do not agree with is your statement about the origin of a hacker — that is someone who spent hours locked away with a home computer. Long before the advent of home computers the hacker had risen to an almost legendary status. The hacker was the person you sent for when you needed some catastrophic software failure — usually on a PDP-11 mini — fixed yesterday.

A good hacker — and by definition there were no bad ones — had, and indeed still has, the ability to fix anything, corrupted file, application program, system software or whatever, and fix it quickly. Naturally, some of these fixes were a little crude but such was the nature of the hacker that most tended to be rather elegant repairs that tended to become accepted as part of the software.

For such a fix the term "a neat hack" was coined.

John Harper,
Roker,
Sunderland.

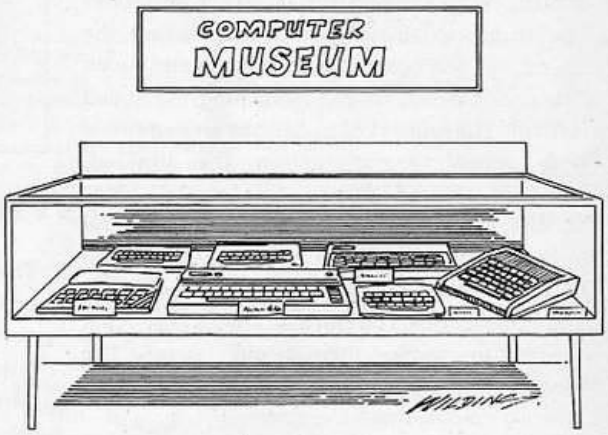
Your Computer now has its own Prestel Mailbox. Our number is 01991800. If you have any program enquiries send us a message. We will try and give you an answer within a few days.

PRESTEL WARNING

I WISH TO issue a warning to future modem owners who are interested in subscribing to Prestel, the British Telecom Viewdata Service. The warning is *watch out, you may be in an area which cannot get Prestel at local call rate.*

(continued on page 27)

"SAVE YOUR OLD COMPUTERS"



I AM WRITING to ask your readers to think twice before throwing any old pieces of electrical equipment out, especially old calculators and computers.

The urge to collect in the human species is such that today's radios, calculators and especially computers will be tomorrow's collector's items — worth perhaps huge sums of money.

To prove my point, one only has to look at the prices old wirelesses fetch. In the days when such things were common, many people threw them away thinking that their ubiquity proved them worthless. And how wrong they were!

The reason I am making this appeal is so that posterity will be able to look at our present-day devices and marvel at their antiquity.

I am already beginning to build up a collection of old and obsolete microcomputers. They can be obtained for practically nothing, often in pristine condition.

So, think twice before you part with that old computer — it could be worth a fortune one day.

Robert Sedgwick,
Grimsby,
South Humberside.

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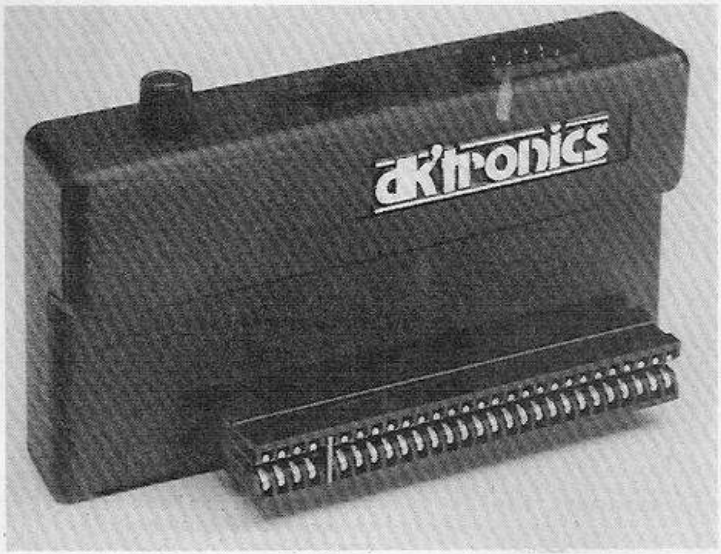

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The Games Player Interface costs only £12.95 and like all our products is covered by a comprehensive guarantee. You can obtain your interface from any good computer store or by completing the order form below and returning it to:*dk'Tronics Ltd, Shirehill, Saffron Walden, Essex.* or by telephone, quoting your Access or Barclaycard number.
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IN ★ TOUCH

How to write for *Your Computer*

We called this magazine *Your Computer* precisely because we welcome your views, tips and hints and even your criticisms of machines and software in general. Here's how you go about getting your name into print. Your article should be typed, double-spaced, on A4 paper. A name and address on each sheet would help. Don't forget to tell us which machine it runs on. With programs please include a cassette or disc and some indication of how long it is. Please put what machine it's for on the envelope. Don't forget full instructions to us how to load and list your program and how to enter it for the readers.

The article must be submitted exclusively to *Your Computer*. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

Telsoft

Telsoft is *Your Computer's* software downloading service. Any program for the Spectrum or the BBC — and soon the Commodore — which has a telephone symbol next to it is available on the service. Both 1200 and 300 baud speeds are catered for. For more details call Colchester (0206) 8068. No more lonely nights typing in endless pages of hex digits.

Message service

You can get messages to us in two ways. Either use the Prestel Telex Link to 892084 BISPRES G or you can use our very own modem, day or night on 01-661 8978. The modem is V21, 300 baud, even parity, 10 bits per character. You simply transmit in upper case "YRC" — our address code, and wait for the acceptance code "+++ STF GO". Then off you go. Don't forget to tell us who it's for. Sign off with "NNNN" — again in upper case.

YOUR Letters

(continued from page 25)

It was only after I had subscribed that I found out that the whole country was not at Local Call Rate.

It looks as if I will have to sell my modem soon as our telephone bills are through the roof. If any other Prestel users who do not get the service at local call rate would like to contact me over Mailbox to exchange views on this, my Mailbox number is 082422531. I shall fight on.

Robert Evans,
Ruthin,
Clwyd.

SCREEN ERROR

THANK YOU for publishing my program Screen. However several errors have occured in the text which could lead to difficulty in using the program. The corrections are listed below Page 101, Column 2.

Line 16 "Pressing shift and graphics will alter the letter to an inverse G indicating that keys with graphic characters will have those as face value while the others are normal face value."

Line 28 "1 Indicates"

Line 31 "2 Will"

Line 34 "3 Then"

Line 38 "Editing of the screen may be carried out at any stage up to new-line on 3".

Page 102 Column 2.

Line 11 "PEEK x+1" (No brackets)

In addition the flash character may be altered by Poking 16772 with the code of the character required.

Mark Stenlake,
Whitwick,
Leicestershire.

CREEPY BUGS

IT HAS come to my notice that my program Creepy Castle — March — as it stands will not work on the Oric-1, only the Atmos. This is mainly due to bugs in the Oric-1's Rom but there is also a missing line from listing 1. There should be a line:

```
4525 POKE # 7800, # 4C:POKE
     # 7803, # 4C:POKE # 7806,
     # 4C
```

When the Oric-1 loads in a block of memory, it decides to adjust the Basic program pointers resulting usually in "out of memory" errors. To get around this problem, insert the following lines in listing 1:

```
25 DOKE1024, DEEK (# 9C):
   DOKE1026, DEEK(# 9A)
32 DOKE # 9C, DEEK(1024): DOKE
   # 9A, DEEK(1026): CLEAR
```

I believe that the Val function on the Oric-1 evaluates hex numbers — preceded by a hash — as zero resulting in the machine-code loader not working properly. This problem can be partially solved by making the following changes to listing 2:

```
10 INPUT "START ADDRESS ( - 1
   TO END)";A
20 IF A = - 1 THEN END ELSE
   C = 0
35 INPUT B
40 IF B = - 1 THEN 80
50 POKE A,B.
60 A = A + 1;C = C + B
```

Now −1 is entered to terminate a block instead of "S" and each number entered must be prefixed by a hash character.

Also, in the article the command for saving "castle3" should read, A6912 after "Castles" not ,A6192.

Myles Dunlop,
Totnes,
Devon.

OPEN WINDOS

THIS IS a modification to Ian Briscoe's Windos program which may be of interest to those without Microdrives — and maybe some, like me, with — who would like a VDU command to make the Windos system easier to operate. There is a bit of unused space between the program and the UDG area, and this is where this fits. Load Windos, then run the following program:

```
10 RESTORE: DATA 17, 118, 27,
   225, 167, 237, 82, 32 ,250, 213,
   223, 254, 44, 192, 231, 205,251,
   36, 253, 203, 1, 118, 40, 6, 205,
   213, 45, 215, 24, 236, 205, 54,
   32, 24, 231
20 FOR n = 65282 TO 65316
30 READ a: POKE n,a
40 NEXT n
50 SAVE "WINDOS" CODE
   60000,5317
```

Following the normal setting up for Windos — i.e., Rand USR 60000: Rand USR 60003 — insert the command Let VDU=65282. Now try the following Basic line:

```
LPRINT USR VDU, 31, 22, 10, 10,
"HELLO", 5, 5, 6, 10, 5, 5
```

This is exactly the same as:

```
LPRINT CHR$ 31; CHR$ 22; CHR$
10; CHR$ 10; "HELLO"; CHR$ 5;
CHR$ 5; CHR$ 6; CHR$ 10; CHR$ 5;
CHR$ 5;
```

Dave Spagnol,
London E2.

CORRECTIONS

Statement 542 in April's QL Tutorial program was omitted. It is located at hex 458 and reads trap # 0. The hex code for this instruction is 4E40.

The hex loader for April's Amstrad Disassembler needs modifying before it can work. Change line 200 to read:

200 POKE address+y,a

and insert

165 y=0

205 y=y+1

The character which precedes the command for enabling the disassembler should be a bar character — shifted @ — and not an exclamation mark as suggested in the text.

The error messages printed in inverse video in lines 6000 to 6040 of April's Spectrum Singlestep program are not clearly visible.

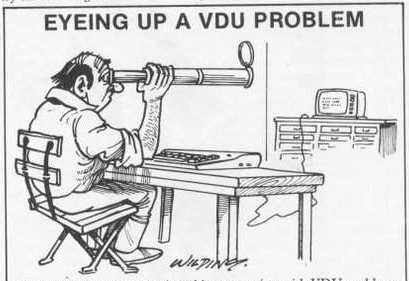
They read, in order:
Number out of range
Not a decimal number
Not a hex number
Not a suitable flag value
Interrupts disabled

Lines 595 and 610 in the listing for April's CBM Pikchachanja are not clearly printed. They should read:

595 GOSUB 800

610 X=X1:Y=Y1:etc

EYEING UP A VDU PROBLEM



ONE FACTOR seldom mentioned in connection with VDU problems is that of viewing distance. A comfortable reading distance for a typical *Your Computer* article is about 40 cm. At this distance a capital A subtends an angle of 17 minutes at the eye. The equivalent distance for a ZX computer on a 12 inch screen is 90 cm, or about three feet, a far cry from the common practice of standing the monitor on top of the computer.

When the screen is too close flicker is exacerbated since more of the screen falls in the area of periphal vision, and also the eye can only comprehend part of the screen at any time, leading to excessive eye movement. My suggestion to those suffering from eye strain is to move the screen further away if at all possible.

Phillip Bender,
Sunderland.

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I could do that...

If the few examples on page 31 stimulate you into giving some thought to making more imaginative use of loops, maybe you'd like to try your hand at this month's First Bytes competition and a chance to win our £15 prize. To enter, simply write a short routine to achieve anything you like — but make sure it incorporates no more than five loops — at least one of which should be nested.

Your program should also include a dynamnic variable linked to the increasing or decreasing value of one loop, and a counter.

Send your entry to First Bytes, Your Computer, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.

P Wilby, 34 Sheldon Close, Bransholme, Hull wins March's competition to write a program that modifies itself. His routine makes program lines which start with five colons invisible when listed.

By changing the first colon to a zero byte it fools the operating system into thinking it has reached the end of a line. To make the lines visible again change the 0 in line 10050 to 58. The program runs on the Vic-20, and the Commodores 16 and 64.

Anyone interested in the subject of self-modifying code might care to look at *Scientific American's* computer recreations feature. A recent issue introduced the fascinating idea of Core Wars — battles between two or more programs in memory at the same time. The aim of each program is to gain control of all available Ram space by replicating itself and attacking the others.

```
10 ::::PRINT "THIS PROGRAM"
20 ::::PRINT "PROTECTS LINES"
30 ::::PRINT "0 TO 9999"
40 ::::PRINT "FROM"
50 ::::PRINT "PRYING EYES"
10000 A=PEEK(43)+PEEK(44)*256
10010 ADDRESS=PEEK(A)+PEEK(A+1)*
256
10020 LINE=PEEK(A+2)+PEEK(A+3)*2
56
10030 IF ADDRESS=0 THEN END
10040 IF LINE=10000 THEN END
10050 POKE A+4,0
10060 A=ADDRESS
10070 GOTO 10010
```

BEGINNERS *first bytes*

Starting out in home computing? First Bytes is for you. Just write to *Your Computer* with any hardware or software problems, no matter how small or simple.

A bluffers' guide to micros

ADMIT IT. You're not really a computer expert. Okay, you know all about what's at the heart of every computer — a microprocessor, of course. You've probably figured out the oblique reply to the question "But what is a home computer for?" (The correct oblique reply is "What is a piece of *paper* for?").

Maybe you even know enough not to get into a situation you can't handle — like trying to sing the praises of a CBM-64 to someone who owns an IBM PC. But at the end of the day there are still those bits of the conversation when names are dropped or antique machines referred to that make you feel like the man who hasn't been reading the FT. No comment.

Well, *Your Computer* is here to help you. Over the next few months we hope to develop, not just your knowledge, but more importantly, your techniques for defence. As with ju-jitsu, skilled micro-bluffing is all about turning aside remarks that threaten to expose your abysmal ignorance.

First, know your enemy. As with all social groups, there is a recognised pecking order among micro owners. A TI-99/4 owner, for example, is treated very often by the rest of the pack as a complete pariah. Why should this be? After all, as the distressed Texas owner often cries out whenever the pack starts circling him: "It is a 16-bit machine!".

Surely a 16-bit micro owner should be able to kick sand in the faces of mere eight-bit micro owners. But as we watch, we discover that for the Texas owner, at least, this is anything but the case.

The encounter is as horrifying in its way to the detached observer as watching a python swallow a lizard whole in a David Attenborough documentary. Nevertheless, it is instructive, since we are already deep in microbluff territory. What is the true meaning of the piteous cry of 16-bit, coming as it does in stark contrast to the rhythmic tribal grunting of "Eight-bit, eight-bit"?

We all know what a bit is, of course. Defined elsewhere as "a boringly dichotomic entity which precludes rational discussion," the bit is more precisely a binary digit. Microbluffs and microbluffers alike all learned at mother's knee that each of the elements comprising the memory of any computer is a binary system — one state denotes 0, the other state denotes 1. But this cannot help our hapless Texas owner. He is the victim of two things: architecture, and history.

First, architecture. The term eight-bit normally refers to the width of the data bus as opposed to the address bus. The job of the address bus is to access addresses in Rom or Ram. The instruction that the address refers to is sent back to the CPU via the data bus. The address bus is one way. The data bus is two-way — for example the instruction the address bus got hold of might require the transferrence of further data from Rom or Ram, or even to the input/output ports (I/O in microjargon).

Most home computers like the Spectrum, BBC, Commodore 64 etc are referred to as eight-bit micros. This refers to the width of the two-way data bus. And the width of the data bus determines how much information is processed in the CPU in a standard amount of time.

Obviously a true 16-bit micro ought to be able to shove twice as much through the CPU in the same standard amount of time. Just like a six-lane highway can carry twice as much traffic as a three-laner. But — and this is crucial to the TI-99/4 — big motorways can create parking problems in the city centre. For all its 16-bit architecture, only 32K of memory could be accessed by the 9900 chip deep in the heart of ever Texas.

And instead of having just an address bus, data bus and control bus, like the 6502, 6809 or Z-80 chips found in most home micros, it had a separate communications register unit I/O bus as well. So it needed an expensive 64K pin package to keep everything moving around. And instead of carrying on-chip registers like conventional processors, it had blocks of work-space registers in Ram memory.

All it had on the chip was a program counter flag register and the register pointing to the current workspace. So basically it's weird. It had its uses as a dedicated chip in military aircraft and so on, but proved to be too expensive and too strange to be bought by people in large volumes — which chips have to be if they are to be worth making. So much for architecture. Now for

(continued on page 31)

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(continued from page 29)
history.

When the Texas came out over here, you could only but it with an NTSC colour monitor, so it could set you back £1,000. (Did you know, by the way, that NTSC stands for Not The Same Colour twice?) It spent a long time at £600 in the UK, went through a peculiar phase of being sold for £200, but you could get another £50 back if you sent off a voucher, and ended its days being sold for around £80. Finally, it was withdrawn from the market.

This is a vital piece of home computer mythology, symbolising the legendary price-cuts that reward the patient. It is also a severe lesson in bad marketing. As Commodore chronicler Mike Tomczyk says of TI in his gross book *The Home Computer Wars*, "I figured that if a giant semi-conductor company that made its own chips charged that much money, they either didn't know how to control their manufacturing costs or were gouging profits at the consumer's expense."

So, to summarise, what the pack is conveying to its victim is basically this: "You are a sucker. You bought something that turned out to be slightly less successful step in evolution that Neanderthal man. Worse, you (a) paid a hell of a lot of money for it, (b) bought it for next to nothing off a scrapheap, (c) were given it for Christmas by a loveable but eccentric uncle who thinks that Prestel is a Jewish delicacy".

The pack is demonstrating its irrational but natural fear of the alien. Nearly all of them are 6502 or Z-80 based. There may be a few Dragon owners who are glad it is not their turn to be picked on. There is little the victim can do to defend himself. "To the initiated, the 9900 chip is powerful and flexible," he may call out — this is a strange mantra he has gleaned from an old copy of *Practical Computing*.

He can point out that the mutant communications register unit I/O bus can address up to 4,096 individual bit I/O lines. But he is clutching at straws — the unique TI speech synthesiser add-on has addressed him more often than he has used the computer to address anything else.

He must divert the attention of the pack. As the baying raises to its peak, he plays his trump card. He yells, "Well, I know for a fact that George over there has got a COMX-35 at home!" and runs like hell.

Paul Bond

BEGINNERS *first bytes*

Elegant programming: using For/Next loops

ELEGANT PROGRAMMING doesn't necessarily mean sitting at your micro wearing a pink carnation and spats — especially if you're female. It's more a question of rethinking those bad old hacking habits you've picked up, so that your self-written Basic routines don't look to others as though you found them at the bottom of a cardboard box.

Take as an example the ubiquitous For/Next loop. It's one of the most powerful Basic commands there is — and probably also the most abused. Check through your own uses of it and you'll doubtless find that you have in all innocence introduced a couple of classic chip-charring catastrophes.

For/Next loops are versatile; use one as a counter set to the number of times you want a particular operation to be executed, to mimic a clock, or to stuff your arrays full of data. They'll always work much better, though, if you observe a couple of golden rules.

First, don't skimp on labelling, especially if you're nesting — that is, introducing one loop or more inside another loop. This is sloppy:

```
10 FOR L = 1 to 10
20 PRINT L
30 FOR D = 1 TO 350
40 NEXT:NEXT
```

Now the proper order of execution might be clear in this simple example — but such routines aren't always so easy to decipher when you're checking over a listing of a program you wrote months before. So why not make the last line

```
40 NEXT D:NEXT L
```

and remove all risk of confusion?

Next, it's wise always to close down a loop when you're finished with it, like this:

```
10 FOR L = 1 TO 10
20 IF L = 7 THEN PRINT
   "SEVEN":L = 10:GOTO 40
30 NEXT L
40 REM PROGRAM CONTINUES
```

There is an exception. You may sometimes want to use the "exhausted' value of L in a subsequent statement. If so, remember that it will usually total one more than the specified value. For example, if you Run the first demo again and then enter Print L in direct mode, you'll find the number printed in response is 11.

Of course, you can also weave in the changing loop value as a dynamic variable in a routine:

```
10 FOR L = 1 TO 10
20 PRINT "*";
30 FOR D = 1 TO (500*L)
40 NEXT D:NEXT L
```

A loop can also be used to create a simple timer. Most micros have a real-time clock held in a reserved string — such as TI$ — but you may want to keep this by for another part of your program. So use a loop instead:

```
10 FOR CD = 10 TO 1 STEP -1
20 PRINT "COUNTDOWN" CD
30 FOR D = 1 TO 350
40 NEXT D:NEXT CD
```

You're probably familiar with the technique for filling one array or more using a For/Next loop equal to the total number of elements involved. However, don't forget that you can nearly always bypass an array provided there are 10 elements or less. Try this:

```
10 FOR L = 1 TO 5
20 READ D$
30 PRINT D$
40 IF D$ = "ORANGES" THEN 60
50 NEXT L
60 PRINT "YOU'RE OUT OF
FRUIT!"
70 END
80 DATA GRAPES, BANANAS,
   LEMONS, PINEAPPLES,
   ORANGES
```

Finally, don't overlook the power that a For/Next loop can bring to all kinds of string-sorting chores. For example, some Basics — such as Commodore's — don't have an equivalent to the INSTR function available on the BBC which searches a string for a specified group of characters and returns its location. But this very useful facility can be emulated:

```
10 A$ = "YOUR COMPUTER"
20 B$ = "PUT"
30 FOR L = 1 TO LEN(A$S)
40 IF MID$(A$,L,LEN(B$)) =
   B$ THEN GOTO 70
50 IF L>LEN(A$) THE PRINT
   "NO MATCH FOUND":GOTO 90
60 NEXT L
70 PRINT "POSITIVE MATCH
FOUND"
80 PRINT "BEGINNING AT
   CHARACTER" L
90 END
```

After trying this version change B$ to "OUR" and Run the program again; next, make B$ = "NIL".

John Ransley

The flexible floppy disc system

ALTHOUGH CASSETTE tape is a perfectly adequate medium for those people who just want to dabble with computers, most serious users find it too hampering for real computing. It is awkward for handling program files and downright obstructive for manipulating data files of more than a handful of records. The remedy most sufferers of data headaches turn to is the floppy disc.

Discs — Americans call them disks or diskettes — are flat, round platters of magnetic material encased in a plastic shell. They come in a variety of sizes; eight inch, five and a quarter inch, three and a half inch, and three inch. There are also a number of different formats, densities and single or double sidedness.

In order to use discs with a micro you need three elements; a disc drive, an interface and some controlling software. Normally, a disc drive will be sold with all three components included in the asking price, however that is not always the case. Most manufacturers market a disc package designed to work with their computer.

The notable exception to this rule is Sinclair Research, who has decided to plough a lonely furrow with the Microdrive. Yet Sinclair owners who desire the flexibility and convenience of floppy discs can turn to the third party disc manufacturers who also market units for other ranges of micros.

When buying a disc unit, it is worth taking a look at the "official" unit for your system first. This is usually the same as the most popular drive and is important because any disc-based software produced for your system is likely to be available in this format. Before purchasing, check that the drive you intend to buy is supported by the software houses.

You will almost certainly want to transfer your library of software to your disc drive. This should be a trivial task as far as converting your own Basic programs is concerned but may be much more difficult for commercial software.

Depending on a number of factors, you should expect to part with around £200 for a single disc drive. A twin drive unit will often cost less than the sum of two singles as the power supply, controller and interface will be shared.

Remember that eight inch discs are a dying breed. Five and a quarter inch discs are still popular, though the drives can be more expensive to buy. Microfloppies — that is the Japanese three and three and a quarter inch discs — are becoming more and more popular all the time; however the discs are expensive to buy costing around £5 each.

Apart from the hardware, you will also be faced with a choice of operating systems. If there is a system specific to your micro, such as Commodore Dos or AMSDOS, you will have little choice. CP/M is a standardised operating system which will open your machine up to a wide range of software.

Bill Bennett

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If you have anything of interest to tell us about your computer club why not contact us on 01-661 3144.

Local news

Memotech

Memotech owners now have a magazine devoted just to them. It has articles on the machine, programs to type in and offers on commercial software. Contact the Memotech Owners Club, 23 Denmead Road, Harefield, Southampton..

Christian

A club has been formed "to promote the use of microcomputers in Church related activities". Christian computer users should contact the Secretary, P.A. Clark at the Christian Micro Users Association, 6 Wakely Street, Sheffield, S6 3RG.

Atari

Atari owners in the Watford area might like to join this likely bunch of WAG's (Watford Atari Group). Yet another offshot of the ever prolific Infomania group, they plan to cover a wide range of Atari related activities. WAG promise a software library and newsletter as well as regular meetings at Infomania HQ. Membership is £15 per year. Interested Atarists should contact Chris Bone (Garston 672235), or write to him for more details at 10 Garston Drive, Garston, Watford Herts WD2 6LB.

Elbug

The publishers of BEEBUG for the BBC have produced a cut-down offshoot for a cut down computer, the Electron. For £9.90 you get 10 issues of ELBUG, and the club provides other facilities such as local user groups, a discount scheme with a number of retailers and a software library. It's available from ELBUG, PO Box 109, High Wycombe, Bucks HP11 2TD.

COMPUTER *club*

Patrick McDermott takes the high road to Glasgow and discovers omnibuses as well as databuses at the S.P.T.E. club.

THERE ARE five, perhaps six, computer clubs around Glasgow. There might be over 100. The difficulty in knowing arises from the fact that they do not make themselves known, particularly to each other. By far the largest and best known is the S.P.T.E. Club organised by John Reid.

When I visited the club for one of the Sunday evening sessions, John was putting on a performance like one of the stall-holders at the famous Glasgow "Barras" market. With a CBM-64, disc drive and monitor, he enthusiastically demonstrated the wonders of computer programming to a gathering of 30 or 40. Not that it seemed necessary to sell them the idea, most listened attentively and stopped him in full flow if he had gone on too quickly.

Elsewhere in the large room, four or five small groups were working on their own, maybe they were playing games; but if they were, then they were silent ones, for games playing is not encouraged until the final hour of each meeting.

The tutorial that was taking place was the easy part of what is a very impressive programming course that forms the main part of the club's activity. This was the second of 12 fortnightly meetings that begin by assuming that the participants have no previous knowledge and end 24 weeks, three test papers and a programming project later.

On completion each member will have a full working knowledge of Basic and a complete set of detailed course notes and exercises for future reference. The course is not as stern as it may sound; the test papers indicate to John and his assistants where extra emphasis is required or if any private tuition is necessary. Just now courses in Sinclair and Commodore Basics are run with an Amstrad course a possibility for the future.

If the whole business seems more like hard work than fun, then that is far from the truth. The membership of 192 is made up mostly from Strathclyde Passenger Transport Executive — S.P.T.E. bus crews and their families, although anyone can join, children with their parents approval only. The meetings take place in the staff function suite at one of the depots, a venue that comfortably provides all the necessary facilities and allows the nightly fee to be kept to 20p for adults and 10p for children.

As with most public computer clubs, there is a span of age groups and while I saw no-one under ten or over fifty, there was a variety of all inbetween working together. Unlike a lot of clubs there was a reasonable representation of female members.

I was surprised to see that there were relatively few computers at the club. Not, I found out, because members didn't have one; but that the organisers preferred people to work together. The theory seemed to work. Spread around the room there were people working on databases, music programs, writing adventure games, helping each other come to terms with machine code as well as Basic. A variety of machines were in use; Commodore 64s, 16s, Vic-20s, BBCs, Amstrads and Spectrums. There were also a variety of monitors, VVS, disc drives and cassettes that seemed freely available.

When younger members found that their joysticks were going down faster than Mary Decker when they played Daley Thomson's Decathlon, John Reid designed and built a more durable customed joystick from the broken one and some extra parts. For more serious breakdowns of computers or peripheries, members can have repairs made via the club which has an arrangement with a local workshop.

Arrangements with other businesses provide discount discettes, discounted software and Activision, and has enabled the club to form its own library. A local book distributor allows the club to review books and then to purchase their choices at a discount. Businesses benefit from greater trade and the club by being able to offer more facilities to its members. Other businesses seeking similar benefits would be made most welcome.

Travelling has never presented any problem to the S.P.T.E. computer club. Free busses are one of the perks of the job and there is no shortage of drivers, a facility that the club intend to make the most of. A full list of outings to computer shows, commercial installations, and some of the computer manufacturers that abound in the area is planned. It is a facility that the club is willing to share with any other local club who dares make themselves known. Other clubs could benefit from both the visits and opportunity to witness an active, well organised and resourceful club at close hand.

The S.P.T.E. Club will welcome any inquiries from business or prospective members and details can be had from the organiser: John Reid, 3 Meadow Road, Partick, Glasgow.

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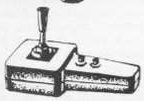

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The XK is available as a kit add-on or fitted to your Spectrum for £5 extra.

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Each page of Ram can have a program running in it, and have a separate screen window dedicated to messages generated by that program.

One major problem is that most of the more complex games such as Alien 8 and Lords of Midnight won't run on an XK Spectrum, and being a soldered-in modification, you can't quickly change back.

Maxam

Amstrad CPC-464
Arnor Ltd.
£59.90

Arnor have come to the serious CPC-464 owner's aid with a comprehensive piece of hardware containing an assembler/disassembler/editor.

The small board plugs into the Amstrad so that most of the circuit board disappears inside the computer under the existing PCB. It provides an expansion bus extension and a slot for further Rom boards. You also get a 50-page manual which explains the use of the Rom-based assembler and the commands available.

Calling the assembler is done from Basic using extended commands.

Arithmetic operators and labels are supported and parameters can be passed from Basic to the code and back.

The RST command is mentioned only rather briefly in the provisional manual provided. As this controls breakpoints. This could have done with more explanation and examples. Aside from this rather minor quibble, this looks like a product no serious Amstrad user can afford to be without.

HARDWARE hitlist

Quick Disk

- *Various*
- *Disc drive*
- *Triton*
- *£129*

THE QUICK Disk is designed as a cheap alternative to floppy disc drives, with only a slight reduction in performance.

There are three versions, Spectrum, Commodore 64 and MSX available, each priced at £129 with 100K 3in discs available at £1.99. The hardware consists of the disc drive and an interface box which plugs into the rear expansion socket of the computer. The performance of the drives is only marginally slower than normal disc drives.

A file takes a minimum of one sector and there are 20 by 2558 byte sectors per side, providing a maximum of 20 files/programs per side. Data files may be transferred between the three types of computers using the discs.

The drive repositions itself at its start position after every operation; this adds a further three to four seconds before the next disc access can be made, but does leave the head out of harms way and the data safe.

The quick disks overall are slightly quicker than the Spectrum Microdrives and appear to be reliable. Command format is simpler than Microdrive, but only just. As the quick disk built in software does not take up any additional space in memory, most software can be converted to run on the quick disk very easily using the conversion program provided in the manual.

There are a few problems with the Spectrum version — the only printer that can plug in directly is the obsolete ZX Printer, the Alphacom 32 does not work from the rear of interface. Interface 1 cannot be connected which loses the RS-232 port and modem facilities although a standard Centronics adaptor does work.

The MSX and Commodore versions do not have to sell against competitively priced products and appear to be good value for money, the Spectrum version needs tidying up to produce a viable alternative to Microdrives and stringy floppies.

Triton Quick Disk.

QCOM

- *QL*
- *Communications*
- *OEL*
- *£200*

BLOODIED BUT unbowed by the demise of Prism and Oric, OEL once again sally forth into the world of microcommunications. Once again they have teamed up with Scicon to produce a formidable product for a Sinclair machine. The hardware consists of three units: QCON, QCALL and QMOD. All three units come in QL livery and styling and stack one upon the other.

The unfortunately named QCON is the guts of the system. It plugs into serial Interface 2. It uses the TI 7000 single chip micro and controls protocols, baud rates, receiving and sending data. This can be plugged into a standard modem with an RS-232 interface, or another QCON on another QL to provide short-distance communications.

This, bought separately, would cost you £75.95 and comes with all the Scicon software. QMOD is an autodial, autoanswer unit which, at £79.95, might seem an expensive luxury to the hobbiest, but will make a big impact with the business user.

QCALL is a standard OEL V21 modem at a standard OEL price of £49.95. The hardware is only half the story. What makes this product worth a second look is the software. You get some idea when they tell you they only have room for one Prestel frame at a time in memory, the rest is filled up by the software!

The computer can be used as either a Viewdata terminal or as a VT100 terminal emulator, even down to simulating the numeric keypad. These models can either be accessed via a series of menus or the confident can just use command words.

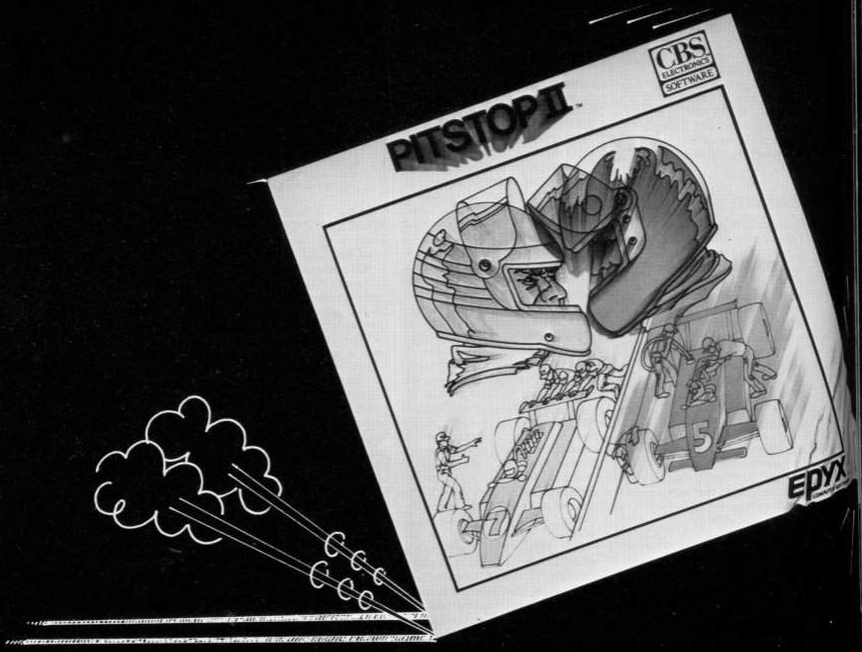
Using Prestel is simple in as far as using Prestel is ever simple. The # and * commands use the Enter and / keys. While on line, frames can be saved, loaded, printed either in text only — i.e., fast — or a full graphics screendump with shading is available which takes a few minutes. The phone book you load on booting the software can contain up to 50 named pages. Each entry on a page is given its own number and prompt string, so once you're through, logging-on is automatic.

The filing commands, again available when on line are very comprehensive, indeed they represent a major improvement on QDOS, with the sort of facilities you would associate with a proper DFS. Data on Microdrive can be encrypted and, if necessary, this encrypted version can be transmitted, with the encryption code sent by some other means.

A command sequence can also be saved on Microdrive. This allows the user to, for instance, write a message for a Telecom Gold mailbox, run his mailbox program and then walk away and let the computer get on with it, even using delayed send to send it while he's asleep!

User-to-User comms works very smoothly. Although 1200 half duplex, time sharing between both ends means it appears full duplex. Both message and file transfer is possible, with checksums sent and echoed in the latter case. Of course, this unique protocol means a QCOM user won't be able to talk to anyone else, even should they wish to converse with such mere mortals in the Spectrum and BBC world.

For the business user, the simple menus and the ruggedness of the software won't leave him with a crashed program and a big phone bill. The hobbiest will revel in the numerous clever facilities, and it might even find a market as a cheap alternative to buying a VT100 terminal for mainframe users.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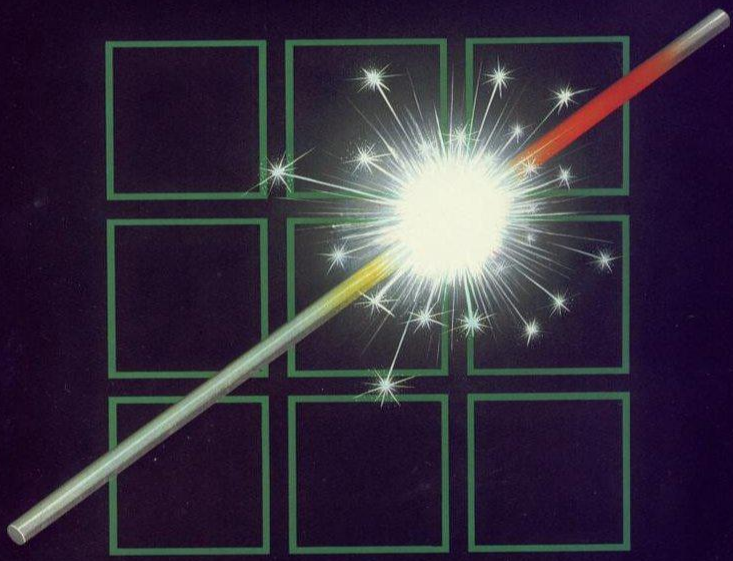

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Star chart

KEY

★★★★★ Best of its type
★★★★ Very good
★★★ Good
★★ Average
★ Below par

Moon Cresta

ZX Spectrum
£6.95
Shoot'em-up
Incentive

★ ★ ★

The Nichibitsu arcade classic, with an opportunity to win your own dedicated Moon Cresta machine. You blast away and score bonus points by docking successfully with the mother ship.

Stay Kool

ZX Spectrum
£6.95
Arcade adventure
Bug-Byte

★ ★

Everyone raved about Manic Miner but what Bug-Byte seem to have forgotten is you must put some oomph into the graphics if you want to get away with this sort of thing. Silly jokes about police boxes and doctors are not enough.

Caveman Capers

BBC Micro
£7.95
Moon buggy derivative
Icon

★ ★

Nice to see some games for the BBC Micro after all this time. Your caveman rides on the back of a perambulating platypus. You must jump holes in the ground but avoid doing this when a low-flying bird is around.

Pole Position

CBM 64
£9.95
Road Race
US Gold

★ ★ ★ ★

The archetypal road-race game for your 64. It's all here, practice round, qualifying round, racing against other vehicles. Only carp is the under-use of CBM-64 sound facilities.

SOFTWARE Shortlist

Formula One

■ *ZX Spectrum*
■ *Management game*
■ *CRL*
■ *£7.95*

★ ★ ★ ★

FOOTBALL MANAGER with racing cars. Fabri, De Angelis, De Cesaris, Piquet — you can hire them all provided they haven't already been bought up by your Spectrum. You can load up previous games, enabling you to continue a tournament over a long period of time, you can use a Kempston joystick and from one to six people can play at a time. There are five levels of play depending on whether you are a novice, junior, average, good or expert manager.

The six teams the players can manage include Brabham, Ferrari, Lotus, Williams, McLaren and Renault. You can also choose to be a driver — the ability to add new games in is a good one: stops the game getting out of date. After this you can select a sponsor, Saudia or Denim or whatever.

Now down to the nitty gritty — choosing your driver and then outfitting the car. Allotted a sum — depending on your sponsors — usually around £630,000, you can improve the driver, chassis, engine and pit crew. The more money you spend on your pit crew the faster they move in the pits. This is crucial, because although the race itself is randomly generated by the micro in the style of Addictive Games' Football Manager, you control tyre changes and adjustments by steering your man around the screen.

The graphics are functional rather than brilliant — but the heads of the crowd turn to watch the cars and the Goodyear airship moves majestically across the screen. After the race you are shown who won and how they're doing in the championship stakes. Other interactive elements of the game include deciding what sort of tyres to use, dependent on weather conditions, and when to go into the pits. Simple, enjoyable, no doubt socially divisive with six people fighting to get at the controls of one Spectrum.

Paul Bond

Sam Stoat Safebreaker

Formula One

Sam Stoat Safebreaker

■ *Spectrum 48K*
■ *Arcade adventure*
■ *Gremlin Graphics*
■ *£6.95*

★ ★ ★

THE LATEST character to emerge from the warren of the Gremlin Gang, Sam Stoat would appear to be as guilty as Monty was innocent. Intent on stealing a very valuable diamond he braves bouncing bedsprings, runaway pool balls, nasty green bottles, pogo gnomes and deadly gnomemobiles in his quest.

Rather like Statesoft's Icicle Works, you get four main scenarios to choose from. Sam prowls about in the dark below four houses ranging from easy to hard. Press the fire button and pop goes the stoat — you're in the house of your choice.

The basic scheme of the game is to locate the explosive bomb and match — then you can blow the safe. Having grabbed the diamond and whatever other jewellery may be lying around in the house, you can then move on. Each house contains 20 screens including the vital bottle of stoat elixir that boosts Sam's blood level — shown graphically in the form of a syringe at the bottom left hand side of the screen. At the top is shown high-score and how much money you personally have gained ill-gottenly.

The maximum score attainable is, we are assured, £64,384. This is not a game that I personally would go wild over. When all's said and done, it has to be remembered that the four houses with 20 screens are just the same house with different levels of difficulty. Some nice graphical possibilities are hinted at, but Gremlin have a little way to go yet if they want to mutate into something bigger and meaner. Keep trying though, lads.

Paul Bond

Icicle Works

Icicle Works

■ *Spectrum 48K*
■ *Boulderdash clone*
■ *Statesoft*
■ *£6.95*

★ ★ ★

DID THE ELECTRO-WIMP band name themselves after the game or vice versa? We may never know. Nevertheless, Icicle Works is a taxing and exciting game which bears many hereditary traits of Statesoft's earlier big hit, Boulderdash, for the Commodore 64.

The similarity lies in tne snowballs. You dash around the screen, clearing paths and collecting parts of objects. If a bunch of snowballs falls on your head, you lose a life.

There are four main screens apart from the entry screen. This last is quite simple. You just saunter down from the top of the screen, grab a two-part key and decide which set of stairs you are going to go down.

In the first set you assemble a jet fighter and release a stream of water.

(continued on page 41)

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Star chart

Mama Llama

CBM 64
£7.50
Arcade adventure
Llamasoft

★ ★

Ingenious 10 by 10 rotating grid enables you to select from five scenarios in which you protect Mama Llama and her two babes voyaging through the cosmos. You can place retrogenesis and antigenesis devices into areas of the game to block attacks for you. This is an irritating game to play — games for purists are all very well but we at YC feel Jeff's getting too involved in his own head.

Frankie 2000

BBC Micro
£7.95
Fantastic voyage
Icon

★ ★ ★

Right-hand side shows X-ray view of human body, indicating where your minisub is in the bloodstream. Left-hand side is the arcade action as you journey through the trachea, etc., shooting germs. In the left lung you encounter cigarette ends!

Berks

Commodore C-16 and Plus 4
£6.95
Robotronesque
CRL

★ ★ ★

More genocide. Tool around shooting at pathetic robot Berks edging their way round a total of 32 randomly generated maze screens. Paralyse the flashing diamonds that threaten to crush you. And serve you right.

Major Blink

Commodore 16 & Plus 4
£6.95
Painter
CRL

★ ★

Major Blink is the creator of the Berks. He is harassed by "bears" and drones who try to stop him painting the blocks on the screen. A competent implementation of this old favourite.

(continued from page 39)

On the second set you build a railway engine while moving around a maze; in the third you attempt to destroy volatile puffins by dropping snowballs on them; on the fourth you assemble a ghetto blaster.

The modus operandi on the last screen is the most ingenious of all. The screen displays a central line of mystery boxes. You knock snowballs down on to them. When you clear a path underneath segments of the ghetto blaster fall from the boxes. You then sweep back and collect the parts. As with the engine and the jet what you are building is gradually displayed on the right-hand side of the screen. Once you have built the radio you start collecting bonus points — but only if you collect the individual letters B-O-N-U-S in the correct order.

Each of the four main screens has exit doors which you use to pass through into ever more mind-boggling levels. You have to get through each part of the game in a certain time — too little time! — this one should appeal to the Chinese puzzle mentality.

Paul Bond

Bug-eyes

- *Icon*
- *Arcade adventure*
- *Spectrum 48K*
- *£6.95*

★ ★ ★

XXABANEANS RULE OK. Well, of course it's not OK since they intend to wipe out all intelligent life and have the universe to themselves. The dummies have invaded earth in a giant starship disguised as a meteorite. Your job is to penetrate down through the 10 levels of the ship and destroy its power generator.

Well-implemented graphics and a sense of humour make this game worthy of comparison with games in the style of Manic Miner. The big-nosed gliding ogre, the terrible twisting thingies, the wigglers and Big Jake all combine to despatch you with a desparing little squeak — all the more pathetic because of the Spectrum's not-wonderful sound capacity.

On the first screen you encounter the stamping stompers, a fiendish arrangement of ascending and descending plungers which make it a little like trying to walk through an internal combustion engine. Your little spaceman can only walk forwards or back, no jetpacking. Timing is of the essence. On most screens it is worth finding a place to ponder on how to scramble through the next set of obstacles.

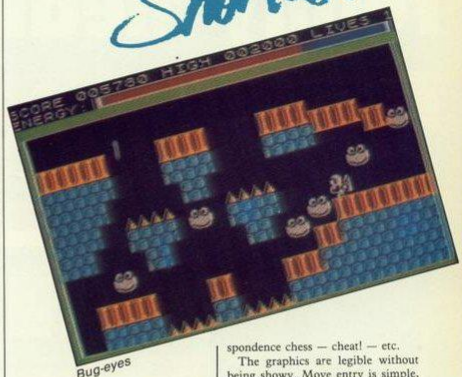
When you fall through into the second screen you face the blinking bouncers. You also have a problem with disappearing bridges. The combinations of problems seem to grow increasingly more complex as you approach the base of each screen. You might miss the bouncers just to find yourself plummetting onto needle sharp rocks from a non-existent bridge.

Lazer phazer blazers, the third screen, is really two screens in one. There are three layers of ray guns then you have to work through a cavern of spiders casually reeling and unreeling from the roof on their grisly gossamer threads.

Icon may not be a prominent name now, but with quality like this they soon will be.

Paul Bond

SOFTWARE Shortlist



Bug-eyes

Colossus Chess 3.0

- *Atari*
- *Chess game*
- *English Software*
- *£9.95*

★ ★ ★

IS THIS THE greatest chess program on a micro? According to the handbook, Martin Bryant's Atari conversion of his Commodore 2.0 original thrashed 21 other programs mostly by 16-0. That includes Odesta's Chess 7.0 — Apple/Atari — based on a former World Champion program. White Knight II — BBC — it beat 13-3, Sargon III 10-6, and the excellent Parker Bros Chess — Atari, IBM PC — written by David Levy's Intelligent Software (Cyrus IS) — by 12-4. The list does not, however, include Psion's 3-D Chess on the Sinclair QL.

I tested it against the Parker cartridge and it confirmed its form. When it plays in Tournament mode — one of the six available — it claims an ELO rating of 1800 and gives moderate club players like me a challenging game. There are easier modes for beginners, plus Infinite and Problem modes for correspondence chess — cheat! — etc.

The graphics are legible without being showy. Move entry is simple, by either typing them in (e2-e4) or using the cursor keys. Pressing the space-bar toggles between the game board and a separate screen which lists the moves, shows the time on each player's clock, position and material rating and the program's latest thoughts.

Colossus also offers most of the other features you might want, including back-step, save and load game, and replay. You can even adjust the weight according to which positions are assessed, as like most programs Colossus will swap a small amount of material for a large positional inferiority.

The only major flaw is the handbook, which is almost illegible — black dot-matrix type on red paper — and has a cover of almost unsurpassed embarrassingness.

Atari chess enthusiasts have a number of options — Sargon, Chess 7.0, David Kittinger's 3-D Mychess, Parker Bros Chess — but except for the awful Atari Chess cartridge, they are all at American prices, i.e., very expensive. The fact that this is British, probably better and third to a fifth of the price makes it a best buy on either tape or disc. Highly recommended.

Jack Schofield

Colossus Chess 3.0

(continued on page 43)

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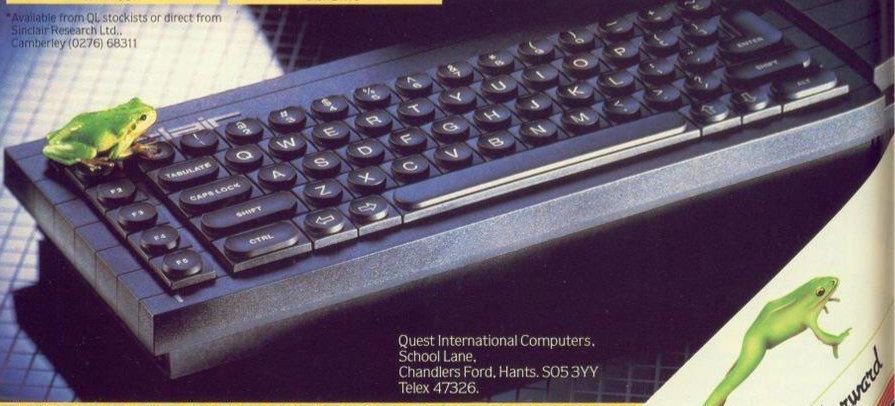

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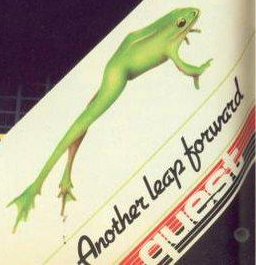

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Star chart

Android 1

CPC 464
Vortex
Shoot-em-up
£7.95
★ ★

Vortex made a name for themselves with TLL and Cyclone. They might have done better to bring out conversions of those games rather than this rather tedious game. Primitive graphics combined with naff sound effects and unoriginal material make this possibly their worst release to date. You have to get to the reactor core before it blows up. To do this, you shoot your way through walls, go through mazes, sideways scrolling and plan views. Naturally there are mutants to blast out of the way.

Don Juan

Oric/Atmos
No Man's Land
Adventure
£8.50
★ ★

Perhaps it was inevitable that sooner or later this French software house would turn to the national obsession — l'amour. Given a choice of a number of young ladies to attempt to seduce, of varying coyness, you must seek to entice them into your little love nest by entering the right keyword at the right time. Some nice humourous touches; might provide some entertainment when inebriated.

Rocketball

C64
IJK
Sport Simulation
£6.95
★ ★ ★

"This was never meant to be a game" in case you hadn't guessed this is Rollerball, hailed at the time as a grotesquely violent film IJK have removed all the blood and gore, and discover underneath a pretty trivial sort of game. Not bad as sport simulation goes, but I don't think International Football will be knocked off its perch by this one.

(continued from page 41)

Banjax

- *BBC*
- *Robico Software*
- *Arcade Adventure*
- *£9.95*

★ ★ ★

BANJAX IS one of those games that is enjoyable to play even though you do not get very far with it. Despite having been given some tips by Robico this reviewer was only able to explore less than a quarter of the game's 240 locations, but liked what he saw: pleasant landscapes, smooth animation, and just enough threats from spiders, blobs and suchlike to keep you on your toes.

It also boasts some of the best graphics in a BBC game since Frak. Like Frak is uses Mode 1 but varies the pallette to give a different four colours in each screen.

Although challenging enough for those who seek challenge, the game has a pleasingly relaxed quality. As the character you control — a bear wearing a baseball cap — is unarmed you must avoid hostile creatures in your path. But if you do not feel up to dodging them you can leave the room. And when you return they are usually gone.

Some rooms, however, are blocked by gargoyles and guards. To gain access more energetic adventures will need to collect an assortment of objects. They will also have to map the territory thoroughly if they are to achieve the goal of the game and reach the Inner Sanctum of the Golden Temple.

Simon Beesley

Tempest

Tempest

- *BBC*
- *Superior Software*
- *Arcade Classic*
- *£9.95*

★ ★ ★

IN HIS excellent survey of the arcades, *Invasion of the Space Invaders* Martin Amis calls Tempest the most abstract of all arcade games. The player is in charge of a claw which patrols the rim of a grid, a cobweb-like shape with lanes converging on a hub.

Out of the hub come a variety of what can only be described as animated geometrical figures — spikes, diamonds, stars, and so on. The player's task is to contain them — with the aid of a blaster or, as a last resort, a super zapper.

This version, translated to the BBC with Atari's approval, is the first to appear on a home computer. In its arcade form the use of sharp vector graphics creates a spectacular display as the various shapes cartwheel outwards and then flip along the rim. But much of the game's impact is lost with pixel graphics: lines look too jagged at this resolution.

Nonetheless Tempest is a sufficiently original game to be worth playing however it is implemented. As far as possible Superior Software have recreated its features faithfully, with nine different grids, 255 levels, and, although rather fuzzy, fast-moving graphics.

Simon Beesley

SOFTWARE Shortlist

Banjax

Flyer Fox

- *Commodore 64*
- *Flight emulator*
- *Tymac*
- *£9.95*

★ ★ ★

A NICE SIMPLE stick and string air combat emulator, spoilt somewhat by the premise that Mig fighters feel the need to shoot down civilian airliners in international airspace. They only do it in Soviet airspace. You are piloting a fighter in escort of a passenger jet. The screen display gives you radar on the left, compass on the right, artificial horizon in the centre plus showing altitude, fuel and score. Messages are also flashed up on the altitude reading to inform you when you are at the same altitude as the jetliner and also to warn you of imminent contact with hostile aircraft.

Flyer Fox

The view from the cockpit shows a flat plain criss-crossed by straight lines to form a geometrical grid. This stretches away convincingly to mountains in the distance. When the game starts you are automatically elevated to the same height as the airliner you are defending.

You can't get any higher than the airliner. It always flies at your service ceiling.

Just before the attack the computer speaks — no add-ons required — and says "Mayday". It says other things at other times, all of them unintelligible.

All in all, good graphics, gripping combat action, garbled speech synthesis, all combine to make a tense and enthralling game.

Paul Bond

Dragon Torc

Dragon Torc

- *Spectrum 48K*
- *Arcade adventure*
- *Hewson Consultants*
- *£7.95*

★ ★ ★

MAROC IS back. So what? Well, this is the entity who vanquished the Lord of Chaos and banished him from his earthly realm — a neat thing to mention in job applications. Afficionados of Hewson's Avalon will remember him; more importantly, they will have experienced the lateral thinking necessary to get things done in this program. Hardly anyone does anything for themselves; Maroc kicks off by projecting his soul — not one of the more manoeuvrable souls I may

(continued on page 45)

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Star chart

A Day in the Life

Micromega
Spectrum
£6.95
★
One of those twee games featuring you-know-who (snigger, snigger) a bloke with bald head and glasses who is (tee-hee) quite important in the (ha-ha) U.K. computer industry.

Oh no, oh no it's no good I can't hold back, it's Sir Clive and the game has really primitive graphics.

Dukes of Hazzard

Elite
Spectrum
£6.95
★ ★ ★
Them good ol' boys can now just roll along your Spectrum. The screen display is excellent and the game is rather more playable than some of Elite's previous offerings.

Up to now the company's main achievement has been the holographic label on the outside of the cassette.

The Duke boys have to make it to the start line of the road race but helicopters, Hell's Angels, and of course, Boss Hog, all conspire against them.

They drive along the motorway changing lanes and chucking bombs at on-coming vehicles. More fun than a traffic jam.

Pacmania

C-16
Pacmanesque
Mr Chips Software
£5.99
★ ★ ★
The old arcade classic revisited on the Commodore 16. Afficianados of Acorn Snapper or other more traditional implementations of the Atari original will probably find themselves shocked and stunned by this version.

The ghosts are completely anarchic, they hold to no known norm of civilised behaviour, recovering almost instantaneously.

(continued from page 43)

say — but quite a lot of Maroc's soul's work is done for him by a servant creature.

To move, you get the arrow pointing to move. Press the fire button once and the scroll changes to show the move you have selected and how many more uses of it you have left. "Project they soul" hints the scroll. In the style of Gargoyle's Tir Na Nog, you have to move around on pathways.

To access the servant, you scroll as before and press the fire button twice. A small will-o'-the-wisp appears which you control with the joystick instead of Maroc.

The graphics are rough — scrolling, sacrificing smoothness for colour, so sometimes irritating to the eyes. But I am sure that the actual mechanics of the game will prove an irresistible addictive factor to adventure fanatics.

Paul Bond

Body Works

- *Spectrum*
- *Genesis Productions*
- *Educational*
- *£14.95*

★ ★ ★ ★

IS THERE a doctor in the software house? Yes, there is, and it's Dr Jonathan Miller, star of stage, screen and operating theatre. If you don't remember Beyond the Fringe you may remember the mammoth documentary called The Body in Question.

The program in question is based on the pop-up book *The Human Body*, also published by Genesis Productions, a new company specialising in books and computer software. Consultant physician David Jefferys also worked on the project and one suspects a lot of the real slog was done by Five Ways Software's Andrew Rutherford (graphics), and Roger Moffat (code).

The program takes you on a trip round your body, dealing with cells, digestion, respiration, circulation, nerves, and muscles culminating in a marathon run simulation.

Interaction is the name of the game. Apart from pushing the space bar to animate each function, you can key in your own data. So you can choose between fats, proteins and carbohydrates in the digestion program.

It's not a biology revision program — it doesn't claim to be.

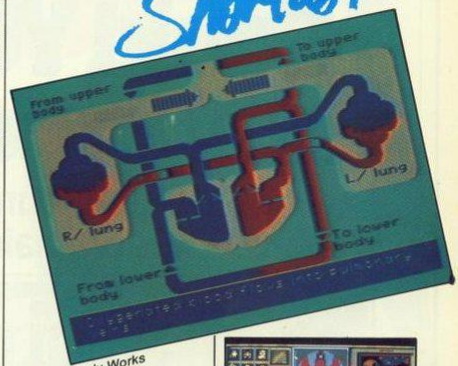
What it is, is an informative and interesting way of putting ideas together for yourself.

The final program in the suite, Marathon, is like a flight simular for the human body. Running eight times faster than real time, the simulation allows you to enter a course from 5-26 miles.

The body monitors displayed on the screen in the form of black graphs include heart rate and output, stroke volume, temperature and lactate.

Paul Bond

SOFTWARE Shortlist



Body Works

Shadowfire

- *CBM/Spectrum*
- *Beyond*
- *Adventure*
- *£9.95*

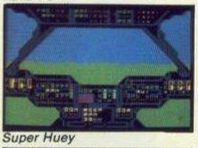
★ ★ ★ ★

IN THIS ADVENTURE your quest is to transport your crack and deadly — why can't they be bungling and harmless for a change — team onto the enemy spaceship. Once there, you have to fight your way through the corridors to rescue Ambassador Kryxix.

All this in 100 minutes of real time before the Ambassador cracks under interogation and tells the bad guys Prince Phillip's Prestel mailbox number. There are six members of your party, each of which have particular strengths and weaknesses. There are various characters around to fight off, doors to open and things like the self destruction mechanism of the ship left lying around.

Lee Paddon

Shadowfire


Super Huey

Super Huey

- *Spectrum*
- *Cosmi/U.S. Gold*
- *Simulator*
- *£11.95*

★ ★ ★ ★

THE GAME goes out of its way to take you gradually through each learning stage till you gain mastery of your "flying gearbox". There's plenty of clear instruction in the manual, including a step-by-step guide on how to get into the air, no mean feat! Once up there your friendly computer will provide you with handy hints on how to stay there.

Once you think you've got the controls sussed, you're ready to proceed onward.

Lee Paddon

Spitfire 40

Spitfire 40

- *Commodore 64*
- *Mirrorsoft*
- *Simulator*
- *£9.95*

★ ★ ★ ★ ★

THERE ARE three display's — the traditional out-of-cockpit, the obligatory map, and a superb reproduction of the Spitfire instrument panel which takes Commodore graphics to new heights. Not combining the instruments with the forward view has two advantages, better instruments and a better view from the cockpit.

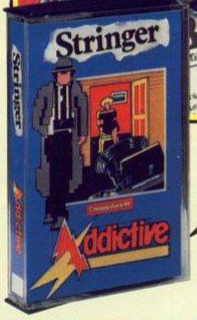
Three game modes are included: practice, combat practice and combat.

Lee Paddon

Could YOU get a Newspaper Scoop?

▸ Addictive launch STRINGER ◂

Reporter Extraordinaire in 'The Hotel Caper'



STRINGER is an arcade adventure game in which you are a press photographer for the "Daily Blurb" set the task of snatching a shot of a Film Star, Polly Platinum in an hotel. To hinder your attempts your camera, flashbulb, press pass and the key to the lady's room have been hidden in the hotel and these items have to be recovered before the all important shot can be taken. To add to your troubles the hotel staff are bent on catching you before you reach your goal and your Editor has set you a strict deadline for the completion of the task.

The game has 5 skill levels and 10 screens of increasing difficulty. It is tantalisingly playable, graphically excellent and, of course – Addictive! Available . . . . Commodore 64 £6.95

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Software Star
"It carries the Kevin Toms hallmarks of attention to detail and carefully tuned difficulty" *Popular Computing Weekly, February 1985.*
"The game can be incredibly subtle" *Pick of the Week, Popular Computing Weekly, February 1985*
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NEWS oaeo rsu tttt h h

The crystal ball

There's some exciting news from those adventure writing geniuses at Level 9. Later this year, they plan to release the first in a series of mega-adventures which they say will be as large, complex and detailed as those published by Infocom. And don't worry if you haven't got a disc drive — they'll also be available on cassette. Cost is likely to be around £15.00.

Enterprise owners have not been overlooked — Level 9 adventures can now be obtained for this machine.

Other imminent new releases from Level 9 include Red Moon — £6.95 — and The Worm In Paradise — £9.95.

Amstrad and MSX owners can now try Melbourne House's famous Hobbit adventure — £14.95 — for themselves. In addition, a reworked version of The Hobbit, on disc only and for Commdore 64, Apple and IBM PC owners, is available in the UK. The new version includes extra problems, additional text, larger vocabulary, enhanced graphics and, for the Commodore 64, complex music throughout the game.

A helping hand

Here's a trio of tips for Spider-Man devotes:
Sandman proving a gritty problem?
ROGN EHT G NILI ECOG
Not getting far up the elevator shaft?
PU OG NEHT UP HS UP
Madam Web a mystery to you?
OTRE HKSA UOYF IUOY ROFS GNIH TNAC SLLI WEHS
Yours in adversity and adventure,
HUGO NORTH.

QUEST Corner

Our man with the brass lamp and the key to a thousand mysteries sheds light on new adventure programs. Lost? Never fear, Hugo North is here.

Heroes of Karn

■ *Spectrum 48K*
■ *£6.50*
■ *Interceptor Micros*

HEROES OF KARN is a text and graphics adventure that first appeared for the Commodore 64. It proved to be very popular and has now been translated for the Spectrum.

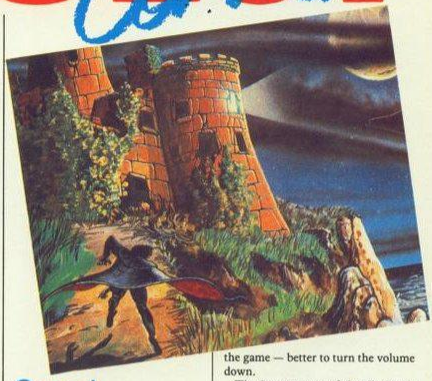
Although the plot and puzzles are identical to the 64 version, the Spectrum program wins hands down in the graphics department, has a small edge in the text input contest but, naturally enough, loses by a mile in the music stakes.

Unlike the 64 version, not every location is depicted graphically but those that are included are magnificent. Credit for the superb computer artwork goes to Terry Greer, as credited by the cassette inlay. The pictures appear instantaneously and are beautifully drawn using colourful high-resolution graphics.

The Spectrum's lack of sound capability means that the impressive music of the 64 version has had to be foresworn. However, the input parser has been tidied up making the acceptance of more complex commands much easier to use.

The plot involves you searching a fantasy land for not one but four lost heroes. The adventure has a host of puzzles, most of which involve hitting on what object to use with what item. The heroes themselves have different capabilities and in certain situations can do things that you could not do by yourself. It is therefore essential that you locate at least one of the lost heroes quite quickly. Finding the first lost hero, Beren, turns out to be quite easy, fortunately.

A thoroughly enjoyable adventure with some of the best graphics on the market.



Grand Larceny

■ *Commodore 64*
■ *£7.95*
■ *Melbourne House*

THIS IS THE second of what Melbourne House call their "joystick adventures". If you've played Zim Sala Bim, their first one of the series, then you'll know precisely what they mean. The adventure is a combination of traditional text and scrolling graphics.

The plot involves your recovering some secret plans which are about to be smuggled out of the country. If the enemy agents believe you are on to them, they will stop at nothing to escape.

You start the adventure outside a large hotel, your first problem being to get inside. The rest of the action takes place inside the hotel which you can explore by riding in the lift or nipping up the fire escape.

The cassette inlay describes the game as having "smooth, arcade style graphics" and "every location brilliantly displayed in 3-D". What you actually get is a minimally animated figure walking in front of some quite uninspiring and very two-dimensional backdrops.

The figure ambles to the left or right in response to the movement of your joystick — or by pressing the "less than" and "greater than" signs on your keyboard. The background scrolls in the appropriate direction.

The graphics mostly consist of hotel rooms and are simplistic stylised representations. Some fairly nondescript music plays throughout the game — better to turn the volume down.

The bottom part of the display is reserved for text input and output. When your character is stationary, you can type in the usual sort of two word command e.g., get knife. The program only recognises the first two letters of each word so abbreviated commands are acceptable. Response to your input is instantaneous but terse.

There seems to be a non-fatal bug in the program. When you move to the extreme left of a floor above ground level and type Look, the description given is not of that location but relates to a location on the floor above.

I found Grand Larceny to be quite tedious, lacking in interesting puzzles and totally devoid of atmosphere. However, if you enjoyed Zim Sala Bim, chances are you might like this one.

Quest for the Holy Joystick

■ *Spectrum 48K*
■ *£4.95*
■ *Delta 4 Software*

THIS QUILLED text adventure is a zany spoof set around the ZX Microfair. You'll encounter many well known characters and companies who bear more than just a passing resemblance to famous names from the world of computer games and adventures.

The is also a sequel — Return of The Joystick — which has graphics and includes some extremely funny pastiche title screens.

The games are available by mail order (04893 5800) and are sure to provide you with many a belly laugh.

COMPUTER C

Meirion Jones investigates a potentially explosive new crime wave instigated by that master of the keyboards — the hacker.

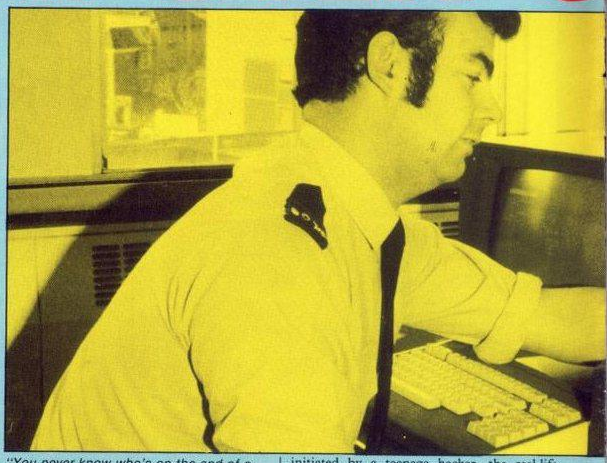
COMPUTER CRIMINALS will steal at least £1 billion in Britain this year — that's a Great Train Robbery every day in 1985. But unlike the train robbers, most of the electronic thieves will get away with it and even if they are caught, financial institutions are unwilling to prosecute because public confidence in them might collapse if people knew how easy it had been to breach their security.

In America the problem is worse still. Computer fraudsters range from high-ranking company officials who have invented whole communities on magnetic tape to make business look as if it's booming — as in the multi-million dollar Equity Life insurance scandal — to individuals who have re-suscitated thousands of dead clients in order to pay the pensions into their own accounts.

Interfering with delivery and accounts programs has also produced spectacular results, in one case the disappearance of 200 rerouted freight wagons, in another the collection of a million dollar's worth of components without payment.

And in the unlikely event of the fraudster ending up in jail, white collar criminals don't need to dirty their shirts digging tunnels to escape, they can always follow the exâmple of the Ohio prisoner, who having access as a trustee to a terminal in the library simply used it to bring forward his release date on the computer.

These are just some of the cases that have been discovered and as Brandt Allen, an American researcher who helped to publicise the problem of computer crime in the early 1970s writes, "the first time I assembled a set of computer fraud cases, I was struck by the incompetence of most of the embezzlers who had been discovered. Since the computer provided such a high degree of fraud potential, I wrote at the time, "I can't help wondering what the really clever people are doing" with the computer. I think the biggest computer frauds are still to be revealed."



"You never know who's on the end of a hacked line. Watch out, there's a computer cop about."

All this pales into insignificance with the fears of Mr X, a British computer consultant who does not wish to be named. So far, most computer crime has been the work of professional criminals or employees who have taken advantage of their privileged use of a computer.

The amateur hackers — equipped with nothing more than a home computer, modem and a quick brain have been more of a nuisance than a threat to the big companies. Despite the fantasies of films like War Games where global thermonuclear war is almost initiated by a teenage hacker, the real-life exploits have been more usually of the order of the diversions of Pepsi-Cola shipments across Canada, which the pupils of Dalton School, Manhattan, reportedly perpetrated, or again in New York crashing a TV network.

But Mr X believes that all this will change in the next couple of years as modems become as common as data recorders and 16 and 32 bit chips give home micros the capabilities of the minicomputers that run companies today. Six years ago a powerful VAX 750 mini cost £80,000 for a machine with 500K Ram and a 15 Megabyte hard disc drive. Atari plans to offer similar kit for less than £2,000 this year and companies like Commodore and Sinclair will not be far behind.

Armed with that power, the hackers may take some stopping. Mr X believes that if something like the mining dispute was to happen again organised team of hackers could cause power cuts, "you don't need pickets,

HOW IT ALL BEGAN

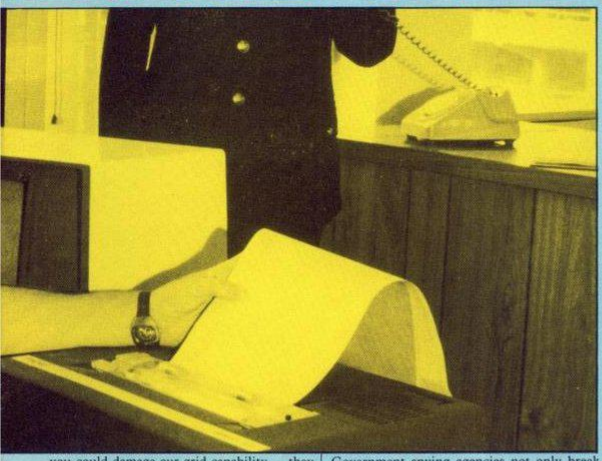
Early computer crimes were unsophisticated but effective. One simple trick, first used in New York was to remove the blank deposit slips on the counters of banks and replace them with apparently blank slips encoded with the fraudster's account number.

When customers filled in the slips as they deposited money the fraudster's account was credited — and with a carefully timed withdrawal from the account the fraudster could be away before anyone noticed that their accounts were awry. Programmers with criminal tendencies who found themselves writing financial software opted for more subtle tricks — the so-called Trojan Horse, a fragment of code buried in a program which looked secure from the outside but which could trigger an unscripted diversion of funds.

These became known as Time Bombs if they were triggered by the central processor clock and Logic Bombs if they were set off by a particular event which might be triggered to suit the programmer. Rather than these one-off raids some villains incorporated subtle routines which stole almost imperceptibly small amounts of money at a time — rounding up cheques by a penny or a cent for instance and sending the difference to their accounts — but on a large number of transactions.

This Salami technique can be very effective in large organisations — one service transfers £27,000,000,000 a day across the Atlantic. You would only need to divert one part in a million to make yourself a millionaire in a matter of weeks.

RIME REPORT



you could damage our grid capability — they could have brought the country down". He also suggests that groups that are opposed to deploying nuclear weapons, like the Greenham women, might be able to disrupt Ministry of Defence Systems — although Sabine Kurjo, who organises anti-war computer users in a Peace Network, has never heard of any such attempts, "none of us would dream of hacking into military computers".

Government cuts which affect scientists' jobs could also be dangerous says Mr X. "Ministry of Defence people are working on systems which can break any computer on earth. The government is paying them to do it — put a few of them out of work . . ."

Government spying agencies not only break their way into private computers, they sometimes deliberately make the job easier by reducing the security of commercial codes.

In America the National Security Agency which runs most of the spy satellites and surveillance interfered with the choice of the National Bureau of Standards Data Encryption Standard to make sure it was set at a level, 56-bit key with 64-bit cryptogram, that the NSA could break. Mr X thinks that the threat posed to major companies by hackers is not just the loss of few percent of turnover as with shoplifting but the complete destruction of their whole organisations. "It's not the petty pilfering, or even the major pilfering that worries them now. If you want to bring down a major company, even IBM, all you have to do is modify profit margins."

Mr X sees a total and unavoidable collapse of companies as the hackers are let loose.

Faced with such apocalyptic predictions it is no wonder that Scotland Yard's computer crime chief Detective Inspector John Austen is calling for a ban on books like the recently published *Hacker's Handbook* which tells you how to set about breaking and entering other people's mainframes down your phone line.

But the book's author, who goes by the name Hugo Cornwall on the title page, believes that hacking is harmless so long as the participants follow a sort of countryside code: "Don't manipulate files unless you are sure a back-up exists; don't crash operating systems; don't lock legitimate users out from access; watch who you give information to; if you really discover something confidential, keep it to yourself." Cornwall also believes that "most hackers are not interested in perpetrating massive frauds. Modifying their personal banking, taxation and employee records, or inducing one world super power into inadvertently commencing Armageddon in the mistaken belief that another super power is about to attack it."

Cornwall prefers to think of hackers as the pranksters who raided Prince Philip's Prestel mailbox and bedevilled every public demonstration of Telecom Gold. Despite assurance from Telecom that the system was secure, Radio @'s Chip Shop presenter Barry Norman found his Gold mailbox raided on a number of occasions and the first demonstration of Telecom Gold on live TV was also disrupted by the appearance of a hacker's message. ■

WATCH OUT–HACKERS

Police fear that the current publicity will give away the "secrets" of hacking and so open up the possibility of computer crime. But once a hacker has the necessary equipment — micro, phone line and modems capable of transmitting and receiving at any baud rate in any protocol and data format which the target computer might use — much of the necessary information such as passwords for breaking into systems is easily available.

Bulletin boards — the electronic noticeboards accessible with a modem, or their more prosaic counterparts, the tatty pieces of paper passed around at computer clubs, often carry a few interesting numbers for enthusiasts to try. For a professional criminal many passwords are easy to find. At exhibitions an access number may be taped to the side of a machine in full view of the public, or typed in while people are watching. A single repeated symbol from the keyboard may trigger a test number and many people use their initials or birthdays as passwords.

Increasing the number of passwords needed to access a system can also cause problems. Clive Blatchford — in charge of ICL's computer security — told a computer crime conference last month that almost no-one who has to remember more than two Personal Identification Numbers trusts their own memories enough not to carry them around in a diary or on a slip of paper. Blatchford told his audience — mainly people in charge of computer security that if he picked their pockets he would expect to find out the PIN numbers for at least one in three of them.

If the hacker has most of the digits of a number, an autodialler can run through the remaining possibilities — although most systems now cut off a modem after two or three false attempts. The professional criminal might buy specialist equipment which can analyse a stream of data and tell you what protocols and formats are being used. Even closed computer networks can be cracked if you can get close enough. £200 would buy a would-be villain a device which could measure the variations in electromagnetic pulse put out by a computer. According to Blatchford an unscreened terminal puts out 150 microvolts 30 feet away — while the device can pick up fluctuations as low as one microvolt. By listening in to the beginning of each transmission the bug could capture the identification codes. No wonder that some companies now spend up to £500,000 to screen a room which is going to take a £50,000 computer.

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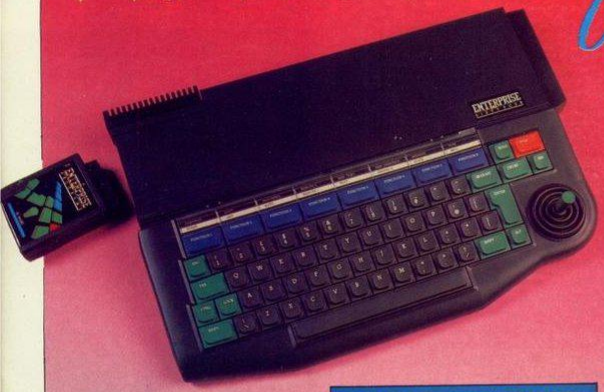
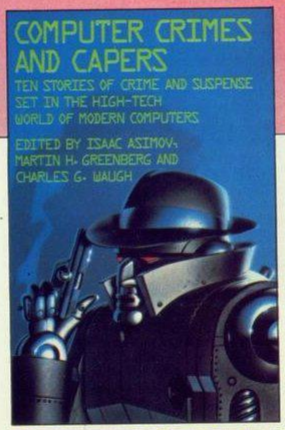
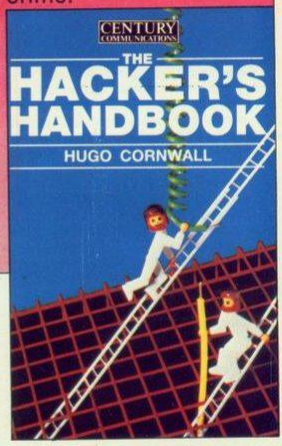


Enterprise computers is putting up its first 128K Ram computer together with a printer and software to make a fabulous first prize.



Runners-up can brush up their cheating with Viking Press's Isaac Asimov collection of silicon science fiction called Computer Crimes and Capers plus...



...The Hacker's Handbook by Hugo Cornwall released by Century which might help you break into the computers that store examination records.

RULES

- The winner of the competition will be the person who, in the view of the editor, comes up with the most amusing or clever idea for a computer cheat or scam.
- The name of the winner will be printed in the August issue of *Your Computer*.
- All entries must arrive at the *Your Computer* offices by the last working day in May 1985.
- Each person may enter the competition only once.
- Entries to the competition cannot be acknowledged.
- No employees of Business Press International or their relatives may enter the competition.
- The decision of the editor is final.
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REVISION SOF

Pete Connor studies revision programs.

EVERY YEAR the nation is swept by an epidemic of exam fever. It begins around Easter and reaches its climax in May and June. Most of the victims suffer no lasting damage, although some do have a relapse known as "retakes". Usually, the trouble passes as quickly and strangely as it has started.

There is no known cure for the complaint; time is the great healer. The only thing the victim can do to alleviate the condition is to take large preventive doses of revision, beginning in mid-winter. In the right doses, revision lessens mental tension and ensures that there will be no need for the misery of retakes.

Many potential sufferers from exam fever will be owners of home computers. Many of the large publishing companies are now producing revision software for a wide range of subjects and machines. Can they help?

In some cases, almost certainly. Penguin Study Software has come up with a series of programs on Shakespeare's plays which shows just how much good educational software can achieve.

The programs run on a database containing three sections: people, themes and acts. So the student can search through each act, or the whole play, searching for references to particular characters or themes. But much more interesting, and useful, is the ability to combine a particular character with a theme in the search.

In Julius Caesar, for instance, the program lists 17 themes ranging from Alchemy to Weeping. Let's say you choose Ambition, combining it with the character of Caeser, and search through the whole play. The screen will display line references — to the Penguin edition, of course — and a comment, e.g. "Look at Act 1 Scene 1 Line 72. Flavius expresses fear, later developed by Cassius, that Caeser's ambition might plunge Rome into dictatorship." Sometimes another reference will be given, or a question for the user or a suggestion that another theme will be worth exploring.

Thus the program constantly makes the user think for himself as well as providing information. It's the kind of service a good teacher would like to give, but never has the time — or perhaps the database — for.

English Literature lends itself readily to this kind of stylish treatment. Other subjects are more traditionally presented and are much heavier going. French, for instance. You're obviously not going to get much guidance on your accent from a computer. And, sadly you won't get an awful lot of guidance on anything else of great value.

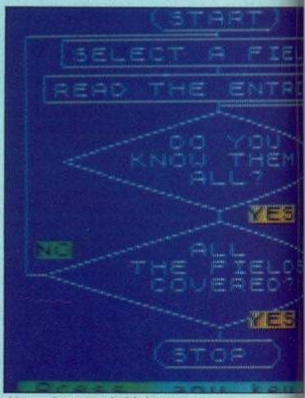
In the Hill MacGibbon/Pan Study Aids Software series you get two tapes and the Pan Study Aid book in a hefty £14.95 package. The program starts off with Diagnostic Test in which you have to choose the answers from an accompanying booklet. On completion you get a report showing how you've done.

The rest of the program is taken up with sections on grammer and areas of vocabulary. It's pretty simply presented, and will certainly ram home all those rules about the agreement of past participles etc., but it doesn't really seem to provide anything to merit the time taken to load it up.

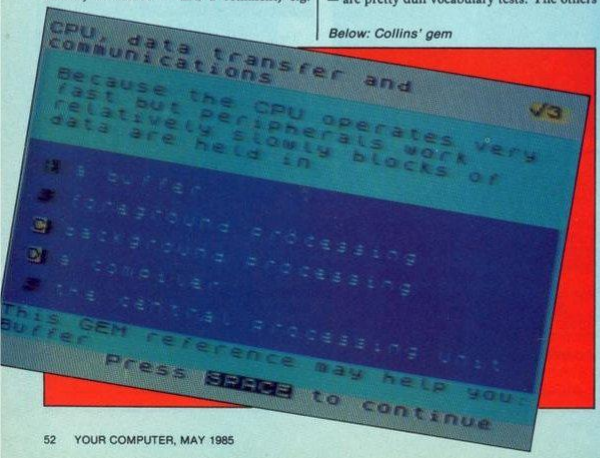
With the Longman French program on the Spectrum you get only one tape. It contains five programs. Two of these — Lexis 1 and 2 — are pretty dull vocabulary tests. The others test knowledge of verbs and of the geography of France.

The most interesting seemed to be a Comprehension program. Here you get a choice of six passages which you are then asked questions on. But, in fact, this was little more than a memory test like those games where you must remember the objects on a tray. Instead of asking questions and expecting grammatical answers, the student is merely required to reproduce exactly each sentence in the passage. All this is accompanied by atrocious "drawings" designed to jog the memory.

Above: Pan biology

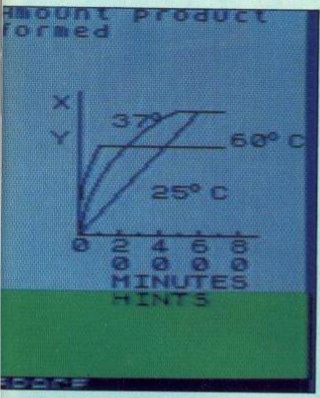


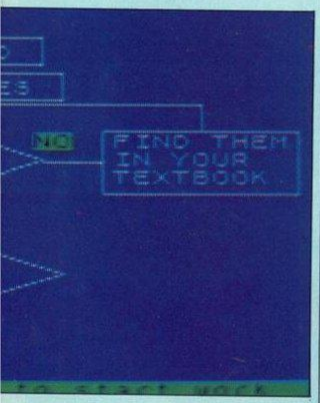
Above: Longman's biology



Below: Collins' gem

TWARE REVIEW





The trouble with language programs is that computers just don't understand what they're talking about and so can only give a very limited number of mechanical and not very useful tests. French is one subject where you're better off with a book, your notes and a teacher.

Biology at least allows you to use diagrams and Longman, Hill MacGibbon, Collins and Scisoft programs all rely heavily on them. Word games are the other favoured means of learning. The Longman package has five programs on the one tape. Of these, Skeleton is the most fun. It's a word game based on hangman in which each correct answer adds another bone with its name.

It's not a terribly original idea, and it hasn't really got much to do with the scientific method, as the blurb claims. But it is quite enjoyable, reinforces the knowledge and covers seven topics. The other programs cover heredity, food and kingdoms.

The Pan/Hill MacGibbon offering is similar to the French package, beginning with "diagnostic tests" and then going on to learning modules covering most of the topics on an 'O' Level syllabus. Since it has two tapes it covers rather more ground than the Longman program. The diagrams are all very clear and the program will be useful to the student — but not that much more useful than his or her own notes. If he or she has got any.

Collins Revision Software is another tape/book package: one tape and the Collins Basic Facts on Biology. The first of the four programs, Tester, asks you to give the answer to definitions from a mixture of topics. Get it wrong once and you're given the first letter, twice and you're referred to the Basic Facts, a third time and you're given the answer.

The other three programs are all diagram-based. The first one, for example, offers the structure of the flower, structure of the eye, kidney tubule, section through a leaf and the human digestive system. The exercises consist of labelling the parts, with plenty of help available if you need it. Again, most of the syllabus is covered and the program will be useful to the student. A pity, though, that the diagrams weren't just a little clearer or quicker on the draw.

Scisoft's Biology is the weakest package under review, even though it does proclaim on the cover "Approved by teachers". Which ones? Where?

Most of it is multiple choice questions on various topics. But each section contains only 20-32 questions, which doesn't really seem enough. There is also a diagram program. The package doesn't really have enough to offer the student in terms of variety or fun. Both Longman and Collins offer Computer Studies revision software, the Collins once more coming in a pack with a Gem Basic Facts.

Longman's tape contains four programs covering most of the syllabus. Topics include Basic routines, file-handling, logic and low-level language. This latter is dealt with in the program Visicode, which gives you 15 commands in a low level language and allows you to write your own programs. This is a particularly useful sction; explanation is clear, graphics are good and it's easy to get any help you might need.

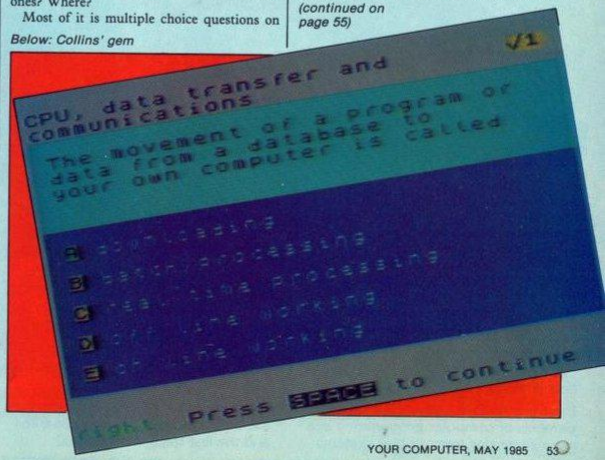
Collins's Computer Studies has the same format as their Biology; three programs in which you must label diagrams and two with multiple choice questions. The program covers much the same ground as Longman's, but is less well organised and therefore not quite so useful. It also contains a truly awful "game", based around darts. It's supposed to be fun, but it isn't.

Longman's do a Physics program as well, and it's pretty good. The four main programs are Formulae, Circuits, Light and Machine. Circuits contains two sections on Ohm's Law, the first of which is a graphich demonstration of the way that diodes and transistors work. It's very clear in its explanations, although the diagrams are constructed rather slowly. The rest of the package is of a similarly high standard.

But it's put in its place by the Physics program in the Penguin Study Software

(continued on page 55)

Below: Collins' gem



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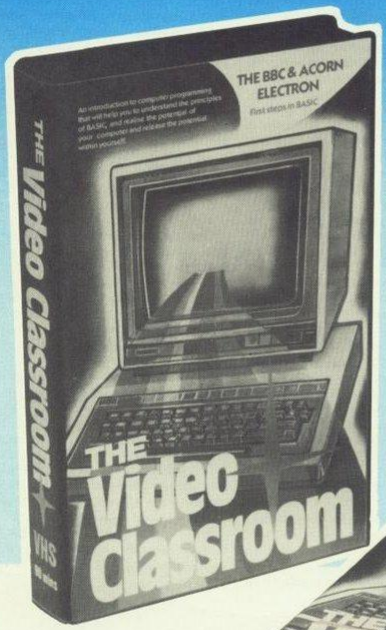

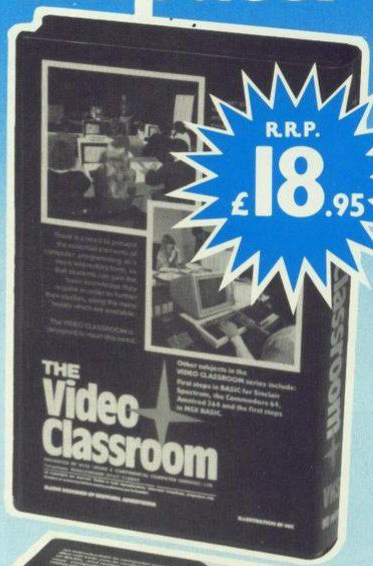

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Video Classroom comes from the originators of the Gemini Integrated Business Systems

(continued from page 53)

series. This really is a very superior product, almost meriting the blurb's claim that it's "the next best thing to having your own private teacher."

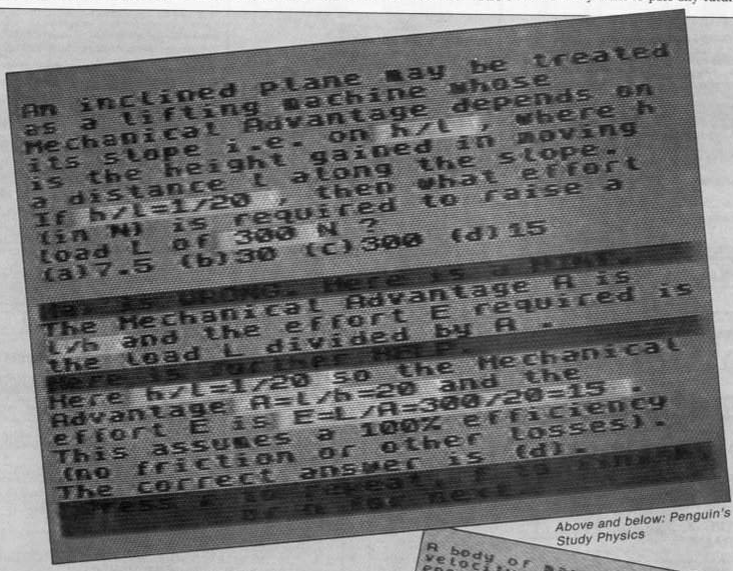
There are two tapes with four programs: Mechanics and Units; Heat and Sound; Electricity and Magnetism; Light, Atomic and Nuclear Physics. Each is presented in a multiple-choice format with a help facility. So, if you're stuck on a question, you can first get a hint, then a detailed explanation with the answer.

The program has a very sophisticated randomising facility. If you want another question on a topic just covered you'll get something similar, but definitely not the same. And the questions are not easy — the program will be useless unless you really have done the work. Which is as it should be in a revision program. Not only is this program more academically useful than others considered here, it is also much classier. It just looks better, with more colour and clearer and faster diagrams.

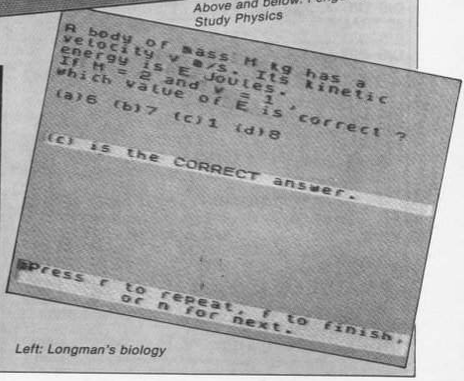
Perhaps this is because the Penguin software has more machine code routines — it's certainly more attractive and much quicker than any of the others. Indeed, too little thought has been given to visual impact in nearly all the programs mentioned here. If someone has a computer the chances are that he or she will have seen countless games of one kind or another, games whose graphics, speed and general presentation put most educational software to shame. The experienced games player is not going to stand for the sort of pathetic "game" presented on Collins's Computer Studies program.

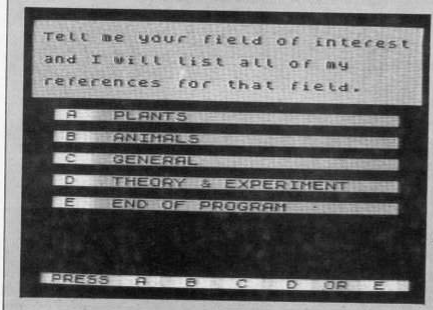
Educationally, none of the programs is without merit. But too many of them do not give the student enough to do and are just not hard enough. And too many of them do not provide anything substantially different from what you would get from a decent set of notes — and if you haven't got those it's unlikely you're going to pass your exams, computer revision or not.

Top of the class, then, comes Penguin for both presentation and content. The other publishers need to pull their fingers out, pull their socks up and get their noses to the grindstone if they want to pass any future exams.



Above and below: Penguin's Study Physics





Left: Longman's biology

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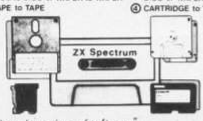

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MATHS MASTER

Colin Carruthers and a Spectrum teach you a thing or two about quadratic equations.

ARE YOU BORED solving systems of equations with five unknowns? Want a hand to invert a couple of matrices? Shouldn't you check that difficult integration problem you've just spent four hours doing?

Well, the computer's ability to plough through tedious calculations at high speed is used in this program to provide a useful maths package.

The program will run on both the 16K and 48K Spectrums, but since it is written entirely in Basic it should be quite a simple task to implement the package on other micros.

As far as possible, each part of the program has been made self-contained enabling the individual to just type in the routines he or she requires. However, the Matrix Operations section demands that the System of Equations routines be present — this is due to the fact that matrix inversion and solving systems of equations can be done by similar techniques and therefore have common program blocks. In any case, the program must have the menu, input a number and hit any key routines — see figure 1.

Figure 1 Program breakdown.

500- 580 :	Input a number routine. Extensive use is made of this routine, so it is placed near the beginning to speed execution.
1000-1180 :	Menu.
2000-2970 :	System of Equations.
3000-3500 :	Quadratic Equation.
4000-4500 :	Equation of third degree.
6000-6650 :	Matrix Determinant and Inverse.
7000-7500 :	Simpson's Rule.
9000-9030 :	Hit any Key to Return.

There now follows a brief description of each part of the program and examples of the kind of mathematical problem they solve. These examples can be used to check that the routines have been typed in correctly.

System of Equations: Solved using Gaussian Elimination, each problem can have a maximum of five equations and five unknowns. The coefficients are held within a two-dimensional array — called "a". The user is prompted for each coefficient of x in turn, with the whole array of values shown on the screen at all times to enable checking.

Ex (n=3)

$$\begin{aligned} x_1 + 3x_2 - 4x_3 &= -11 \\ 2x_1 - x_2 + 3x_3 &= 10 \\ 4x_1 + x_2 - 2x_3 &= 3 \end{aligned}$$

(continued on next page)

```
100 GO TO 1000
500 LET a$="": LET dps=0
505 IF integer THEN LET dps=1
510 PRINT AT v,y;a$;CHR 8;"  "
515 IF INKEY$="" THEN GO TO 515
520 LET a$=INKEY$: IF a$="" THEN GO TO 520
525 IF dps=1 AND LEN a$>=length THEN GO TO 560
530 IF a$=".' AND NOT dps THEN LET a$=a$+a$: LET dps=
1: GO TO 510
540 IF a$="-" AND a$="" THEN LET a$=a$: GO TO 510
550 IF a$="0" AND a$="0" THEN LET a$=a$+a$: GO TO 5
10
560 IF CODE a$<13 AND a$<>"" AND a$<>"-" THEN PRINT A
T v,y;a$;" ": RETURN
565 IF CODE a$<12 AND LEN a$>=1 THEN IF a$(LEN a$)="
" THEN LET dps=0
570 IF CODE a$<12 AND LEN a$>=1 THEN LET a$=a$: TO LE
N a$-1): GO TO 510
580 BEEP .5,-18: GO TO 510
1000 REM menu
1010 BORDER 0: INK 7: PAPER 0
1020 CLS : POKE 23609,30
1030 PRINT AT 3,3;"1 System of Equations";AT 5,3;"2
Quadratic Equation";AT 7,3;"3 Equation of 3rd Degree"
;AT 9,3;"4 Matrix Operations";AT 11,3;"5 Simpson's M
ethod"
1035 PRINT AT 13,3;"0 Quit"
1040 PRINT AT 21,3;"Enter Number -> "
1050 LET v=21: LET y=28: LET integer=1: LET length=1
1060 GO SUB 500: IF a$>"5" THEN BEEP .5,-18: GO TO 106
0
1065 IF a$="0" THEN STOP
1070 IF a$="1" THEN GO SUB 2000
1075 IF a$="2" THEN GO SUB 3000
1080 IF a$="3" THEN GO SUB 4000
1085 IF a$="4" THEN GO SUB 6000
1090 IF a$="5" THEN GO SUB 7000
1180 RUN
2000 REM simultaneous
2005 LET t$="System of Equations"
2010 LET matrix=0: CLS : PRINT AT 1,3;t$;AT 5,3;"a(i1
)=1 + a(i2)*x2 ... + b";AT 8,3;"a(2i)=1 + a(22)*x2 ...
 + b2"
2019 PRINT AT 7,3;"  .  .  .  .  .  ."
2020 PRINT AT 9,3;"  .  .  .  .  .  .";AT 9,3;"a
(n1)=1 + a(n2)*x2 ... + bn"
2030 PRINT AT 15,3;"Enter Order n (2-5) -> "
2040 LET v=15: LET y=26: LET integer=1: LET length=1:
GO SUB 500
2045 IF a$="2" OR a$="5" THEN BEEP .5,-18: GO TO 2040
2050 LET n=VAL a$
2052 LET max=n+1: IF matrix THEN LET max=2*n
2055 DIM a(n,max)
2055 CLS : PRINT AT 8,3;t$
2057 LET v=19: LET integer=0: LET length=5
2058 IF NOT matrix THEN FOR j=1 TO n: PRINT AT 3,6+(j-
1);"x";j: NEXT j
2060 FOR i=1 TO n: FOR j=1 TO n
2062 PRINT AT 2*i+3,6+(j-1);"a";i;j;")"
2064 NEXT j: IF NOT matrix THEN PRINT AT 2*i+3,6+(j-1)
;"b";i
2066 NEXT i
2068 FOR i=1 TO n
2072 LET upper=n+1: IF matrix THEN LET upper=n
2080 FOR j=1 TO upper
2090 IF j<>n THEN PRINT AT 15+j,3;"a";i;j;")" + ": GO
TO 2094
2095 PRINT AT 15+j,3;"  b";i;" = "
2100 LET v=15: GO SUB 500
2105 LET a(i,j)=VAL a$
2107 NEXT j
2109 FOR c=15 TO 21: PRINT AT c,0;"                    ": NEXT c
2110 GO SUB 2000: NEXT i
2120 IF matrix THEN GO SUB 6500
2130 IF matrix THEN IF det=0 THEN GO TO 9000
2200 FOR i=1 TO n
2210 LET piv=a(i,i)
2215 IF piv=0 THEN GO TO 2900
2220 FOR j=1 TO max
2230 LET a(i,j)=a(i,j)/piv
2240 NEXT j
2250 FOR k=i+1 TO n
2255 LET piv=a(k,i)
2260 FOR j=1 TO max
2270 LET a(k,j)=a(k,j)-piv*a(i,j)
2280 NEXT j
2290 NEXT k
2300 NEXT i
2310 FOR k=n-1 TO 1 STEP -1
2320 FOR j=1 TO n
2330 LET piv=a(k,k)
2340 FOR m=1 TO max
2350 LET a(k,m)=a(k,m)-piv*a(j,m)
2360 NEXT m
2370 NEXT j
2380 NEXT k
2390 IF NOT matrix THEN FOR i=1 TO n: PRINT AT 15+i,3
"x";i;" = ";a(i,n+1): NEXT i: GO TO 9000
2400 FOR i=1 TO n: FOR j=1 TO n
2410 LET a(i,j)=a(i,j+n)
2420 NEXT j: GO SUB 2000: NEXT i
2425 PRINT AT 3 : PRINT "Inverse"
2430 GO TO 9000
2900 PRINT AT 2*i+3,8;"
                    "
2910 FOR k=1 TO upper: IF ABS a(i,k)<0.001 THEN LET a(
i,k)=0
2920 LET n$=STR$ a(i,k)+"     ": LET n$=n$( TO 5): IF
n$(1)=".-" THEN LET n$=" "+n$( TO 4)
2930 PRINT AT 2*i+3,4+(k-1)*6; n$: NEXT k: RETURN
2980 LET new=0
2985 IF matrix THEN GO TO 2948
2990 FOR p=1 TO n
2920 IF a(p,i)=0 THEN LET new=p
2930 NEXT p
2940 IF new=0 THEN PRINT AT 16,3;"No Solution": GO TO
9000
2948 FOR m=1 TO n+1: LET temp=a(i,m): LET a(i,m)=new
a(i: LET a(new,m)=temp: NEXT m
2965 LET piv=a(i,i)
2970 GO TO 2220
3000 REM quadratic
3010 CLS : PRINT AT 1,3;"Quadratic Equation";AT 5,3;"A
x + Bx + C = 0"
3020 LET v=9: LET y=7: LET integer=0: LET length=5: PR
INT AT 9,3;"A = ": GO SUB 500: LET a=VAL a$
3024 IF a=0 THEN BEEP .5,-18: GO TO 3020
3025 LET v=11: PRINT AT 11,3;"B = ": GO SUB 500: LET b
=VAL a$
3030 LET v=13: PRINT AT 13,3;"C = ": GO SUB 500: LET c
=VAL a$
3040 LET b=-b/2/a: LET d=b*b-c/a
3050 IF d=0 THEN GO TO 3180
3055 IF d<0 THEN GO TO 3280
3060 LET v=SQR (-d)
3070 PRINT AT 17,3;"Real part: ";b;AT 19,3;"Imaginary:
+/- ";v: GO TO 3380
3180 PRINT AT 17,3;"Equal roots: ";b
3110 GO TO 3380
3280 PRINT AT 17,3;"Real: ";b+SQR d;AT 18,3;"Real: ";b
-SQR d
3290 GO TO 9000
3300 REM 3rd degree
4010 CLS : PRINT AT 1,3;"Equation of 3rd Degree";AT 5,
3;"Axxx + Bxx + Cx + D = 0"
4020 LET v=9: LET y=7: LET integer=0: LET length=5: PR
INT AT 9,3;"A = ": GO SUB 500: LET a=VAL a$: IF a=0 TH
EN BEEP .5,-18: GO TO 4020
4030 LET v=10: PRINT AT v,3;"B = ": GO SUB 500: LET b=
VAL a$
4040 LET v=11: PRINT AT v,3;"C = ": GO SUB 500: LET c=
VAL a$
4050 LET v=12: PRINT AT v,3;"D = ": GO SUB 500: LET d=
VAL a$
4060 LET b=b/a/3: LET c=c/a: LET d=d/a
4070 LET a=c/3-b*b
4080 LET m=d-b*c+2*b*b*b
4090 LET h=4*a*a*a+m*m
4100 IF ABS h<10^-8 THEN GO TO 4300
4110 IF h>0 THEN GO TO 4200
4120 LET f=2*SQR (-a)
4130 LET g=ACS (m/2*a*SQR (-a^3))/3
4135 LET e=f*COS (g-pi/3) LET d=-f*SIN (g-pi)
4140 LET i=-f*SIN (g-pi)
4150 LET c=c-b: LET d=d-b: LET i=i-b
4160 PRINT AT 16,3;"Real: ";c;AT 17,3;"Real: ";d;AT 18
,3;"Real: ";i
4170 GO TO 9000
4200 LET h=SQR h: LET f=-.5*(h+m): LET g=-.5*(h+m): LET
k=i/2
4210 LET i=ABS (f*h+SQR f
4220 LET g=ABS g*h+SQR g: LET h=B.5*SQR 3
4230 PRINT AT 15,3;"Real root: ";f+g-b
4240 PRINT AT 17,3;"Real part: ";-.5*(f+g)-b
4250 PRINT AT 18,3;"Imaginary: +/- ";h*ABS (f-g): GO T
O 9000
4300 IF ABS a<10^-8 PRINT AT 16,3;"Triple: ";-b:
GO TO 9000
4310 LET f=-ABS (.5*m^(1/3)+SQR e
4320 PRINT AT 16,3;"Real: ";2*f-b
4330 PRINT AT 17,3;"Equal root: ";f-b
4380 GO TO 9000
6000 REM Matrix
6010 CLS : LET matrix=0: LET t$="Matrix Operations"
6020 PRINT AT 1,3;t$;AT 8,3;"a(i1) ,a(i2) ... a(in)";AT
9,3;"a(2i) ,a(22) ... a(2n)";AT 10,3;"
  ...";AT 11,3;"a(ni) ,a(n2) ... a(nn)"
6025 PRINT AT 4,3;"Inverse and Determinant";AT 5,3;"of
 non Matrix"
6030 GO TO 2030
6500 REM det
6505 FOR i=1 TO n: FOR j=1 TO n
6510 LET a(i,j)=a(i,j)
6512 NEXT j: NEXT i
6514 LET det=1
6516 FOR m=1 TO 2 STEP -1
6520 LET piv=a(m,m)
6530 IF piv=0 THEN GO TO 6680
6535 FOR i=1 TO n
6540 LET q=a(i,m)/p
6550 FOR j=1 TO m
6560 LET a(i,j)=a(i,j)-q*a(m,j)
6570 NEXT j
6580 NEXT i
6590 NEXT m
6595 FOR i=1 TO n: LET det=det*a(i,i)*n: FOR j=1 TO n:
 LET a(i,j)=a(i,j)*n: NEXT j: LET a(i,i)=n: NEXT i
6597 PRINT AT 17,3;"Determinant = ";det
6599 IF det=0 THEN PRINT AT 18,3;"-> No Inverse"
6599 RETURN
6680 LET new=0: FOR i=1 TO n-1
6610 IF a(i,m)<>0 THEN LET new=r
6620 NEXT i
6630 IF new=0 THEN LET det=0: GO TO 6595
6640 FOR i=1 TO n: LET a(m,i)=a(m,i)+a(new,i)*a(i,m)
LET i
6645 LET p=a(new,m)
6650 GO TO 6530
7000 REM simpson's
7010 CLS : PRINT AT 1,3;"Simpson's Method -";AT 3,3;"A
pproximate integral"
7020 PRINT AT 18,3;"Enter a function in x ";AT 12,3;"e.
g.  y = 3*x+2"
7030 INPUT "y = ";LINE f$
7040 PRINT AT 18,3;"                    ";AT 12,3;"
                    "
7050 PRINT AT 10,3;"lower = ": LET integer=0: LET v=
10: LET y=23: LET length=8: GO SUB 500: a=VAL a$
7060 PRINT AT 12,3;"upper = ": LET v=12: GO SUB 500:
LET a=VAL a$
7065 IF a<=a THEN BEEP .5,-18: GO TO 7060
7070 PRINT AT 14,3;"samples - ": LET v=14: GO SUB 500:
LET p=VAL a$
7080 IF p<=0 THEN BEEP .5,-18: GO TO 7070
7090 LET h=(a-b)/2/p
7100 LET s=b: LET t=b: LET y=VAL f$
7110 LET s=s+y: LET t=t+y: LET y=VAL f$
7120 LET s=s+y: LET t=t+y: LET y=VAL f$
7130 LET s=s+4: LET p=p-1
7140 IF p>0 THEN GO TO 7110
7150 LET t=s+h/3
7160 PRINT AT 17,3;"Integral = ";t
7500 GO TO 9000
9000 LET a$="": IF INKEY$="" THEN GO TO 9000
9010 PRINT AT 21,3; (W 4; INVERSE 1);"HIT ANY KEY TO R
ETURN"
9020 IF INKEY$="" THEN GO TO 9020
9030 BEEP .02,74.4: RETURN
```

(continued from previous page)

This has the solution $x_1 = 2, x_2 = -3$ and $x_3 = 1$.

Quadratic equation: The roots are found using the classic formula:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

This routine allows for both real and imaginary roots.

Ex 1 $x^2 - 3x + 2 = 0$ gives x = or 2
Ex 2 x^2 6x + 10 = 0 gives x = 3+/-i
Ex 3 $x^2 - 6x + 9 = 0$ gives x = 3 (double root?

Roots of a polynomial

Equation of third degree: This routine gives the roots of a polynominal with a term in x^3. Again, imaginary roots are catered for, giving four types of possible solution.

Ex1 $x^3 - 6x^2 + 11x - 6 = 0$
gives x = 1,2,3

Ex2 $x^3 - 3x^2 - 3x - 1 = 0$
gives x = 1,1,1

Ex3 $-x^3 - 9x^2 + 81x + 729 = 0$
gives x = 9,−9,−9

Ex4 $x^3 - 5x^2 + 7x + 13 = 0$
gives x = −1, 3+/−2i

Matrix Operations: The determinant of the given square matrix is calculated and displayed. Assuming that this is non-zero, the inverse is computed using Gaussian Elimination. A matrix with zero determinant has no inverse. The main "invert" routine is the same as that for the System of Equations.

Ex
(n=3)

3	1	2
2	1	0
2	1	1

has determinant 1
and inverse

1	1	−2
−2	−1	4
0	−1	1

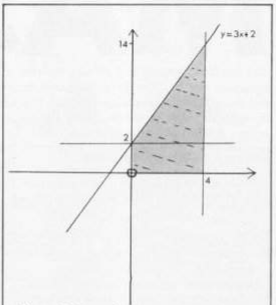

Figure 2. Area of triangle + rectangle.
= ½ x 4 x 10 + 2 x 4
= 20 + 12
= 32

Note that only real matrix elements are allowed.

Simpson's Rule: The function entered must be a valid expression in 'x', for example 'y = 3x+2' must be entered as:

y = 3*x+2

Also, functions such as Sin, Tan or Ln must be entered as single-stroke key words. Any invalid expression typed in response to the prompt will result in an error at line 7100, statement 3. If this should happen, simply type:

GO TO 7000

and re-type the expression correctly.

Ex
y = 3*x+2
lower x = 0
upper x = 4
samples = 10

Value of the integral

As can be seen by looking at figure 2, the value of the integral — or shaded part of the graph — should be 32.

Type in the program as it is listed and check the operation of each segment using the given examples. They have been chosen to test all parts of the program and should make any typing errors apparent. When all is well, save the package by typing:

CLEAR: SAVE "Maths" LINE 100

This prevents any variables being dumped along with the program. ■

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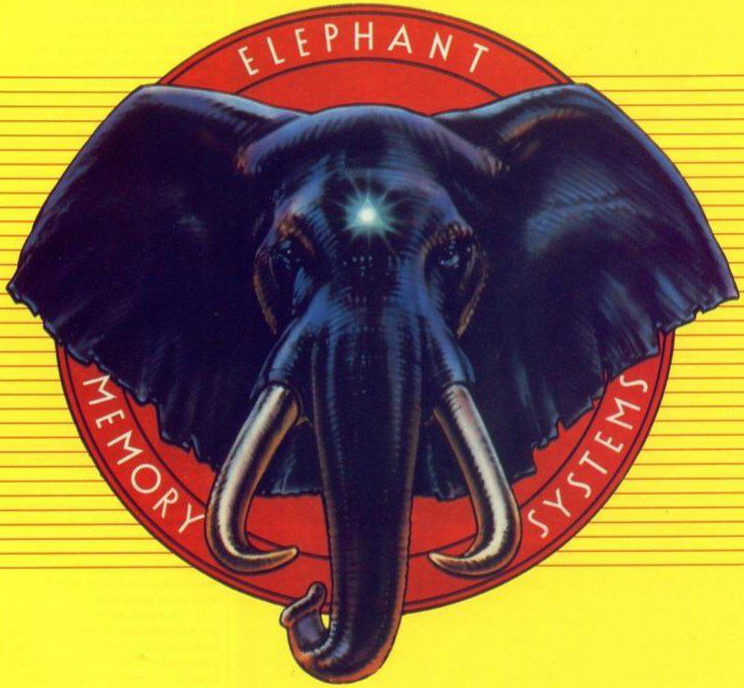

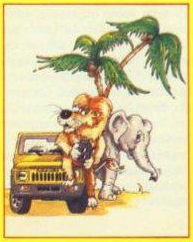

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AMSTRAD AND SP

LANDSCA

Fill in the background to that text-only adventure. Artist Brian James puts pixel to phosphor.

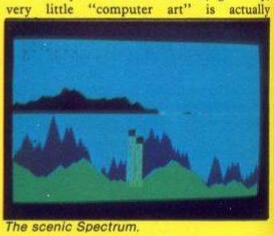
Program 1.

```
10 '        Fourier Synthesis
20 '
30 '          AMSTRAD BASIC
40 '
50 '       Brian James ,  March 1985
60 '
70 c$=CHR$(13)
90 KEY 135,"mode 1:ink 0,1:ink 1,24"+c$+" list "
100 KEY 137," edit ": KEY 128," goto "
120 SPEED KEY 12,2
130 SPEED WRITE 1
170 '
180 DIM a(250),b(250),c(250)
185 '
190 MODE 0          ' for 16 colours
200 nn=6            ' number of terms
210 am=30           ' maximum amplitude
220 INK 0,11        ' blue sky
230 '
240 FOR i= 1 TO 15
250 INK i,RND*26     ' set colours
260 NEXT
270 '
280 FOR n= 1 TO nn  ' Each wavelength
290 a(n)=RND*80/n   ' amplitudes
300 b(n)=RND*2*PI   ' phases
310 c(n)= RND*15     ' colours
320 NEXT
325 PRINT: PRINT" Fourier Synthesis"
330 '
340 FOR x=0 TO 639 STEP 4
350 PLOT x,0,0      ' at bottom
360 y=10
370 k=2*PI*x/640
380 '
390 FOR n= 1 TO nn   'incr. frequencies
400 y=y+a(n)*(1+SIN(n*k+b(n)))  'add waves
410 DRAW x,y,c(n)   ' draw upwards
420 NEXT n
430 '
440 NEXT x           '  go right
450 '
460 FOR i= 1 TO 3000:NEXT   'pause
470 RUN
500 '
6000 WHILE 1:SAVE "":WEND
```

THE LANDSCAPE Creator is a program which creates detailed coloured landscape views, quickly and spontaneously. I developed this idea first on the Spectrum 48K, and now the program has been redesigned to fully exploit the beautiful graphics capability of the Amstrad CPC-464.

It is a simulation of "creativity": the computer makes all decisions relating to a wide range of parameters concerning the hills, trees, flowers, lakes, islands, and buildings. The number of variable parameters is such that the resulting scene gives endless, unexpected surprises with a wide range of possible colour schemes.

I developed this idea because, generally, very little "computer art" is actually



The scenic Spectrum.

generated by the computer. In nearly all cases the computer merely displays the picture, which is arranged by the programmer. We now have graphics packages which make it much easier for the operator to control the results on the screen. However, the result could just as well — or even better — be done with paint on canvas.

It is a much more interesting challenge to get the machine to create its own pictures, based on a "knowledge" of the subject to be portrayed. This involves intricate mathematical modelling, and really begins to unleash the power and the intelligence of the microchip and do things in a way only the computer can.

We have all seen some impressive colour graphics in computer games. In most cases these graphics make extensive use of user defined characters, which are rectangular elements — usually 8 by 8 pixels — used as building bricks. In contrast to this, the use of mathematical functions and probability theory allows us enormously improved flexibility, enabling the spontaneous creation of different scenes, giving endless surprises, even to the programmer!

It is easy enough to write a program to rearrange a number of graphic shapes — say to

CTRUM
PES

select a building from a choice of five, choose a mountain from a choice of five, etc. etc. and put them together. But to simulate the idea of "creativity", we need to use a whole hierarchy of routines, building up the picture from the smallest elements, with freedom of choice at every stage in the process. User-defined characters are of limited use in this kind of exercise.

My objective in the Landscape Creator was to have the minimum of fixed quantities: to allow the greatest freedom for variations, without departing from some basic properties of landscapes. This same idea I used in Country Cottages, a fun game for two players where you buy cottages and try your skill in managing the awful tenants.

The cottages, the landscapes and the tenants are different every time you play the game. However, the Landscape Creator was designed from scratch, to produce greater variations, better colour schemes, better appearance of water and vegetation.

The number of calculations involved is quite horrendous. Just doing a single pixel involves over 50 machine-code instructions. Though Amstrad Basic is very comprehensive and quite fast, the Landscape Creator has so many calculations to do that machine code was essential.

Routines for plotting

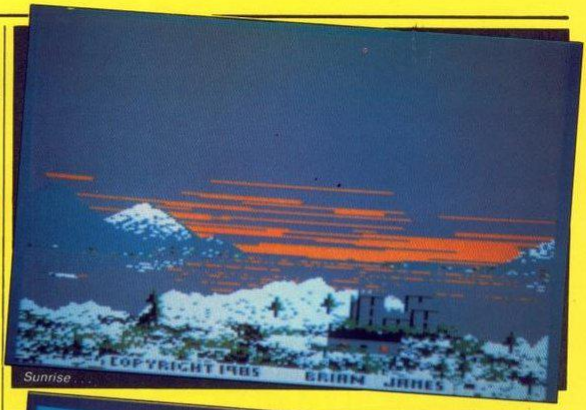
The Amstrad Firmware manual gives the addresses of inbuilt machine-code routines for plotting. These are easy to use and nicely crashproofed — but are therefore not as fast as would be desired. The Landscape Creator utilises its own extremely fast, compact plotting routines. Also the basic arithmetic routines were designed for the job.

In the Landscape Creator, the object was to have the maximum variety of pictures. Whether it is creating a rugged skyline, an island, a patch of buttercups, or a castle, a flexible routine is used which combines probability functions with appropriate mathematics.

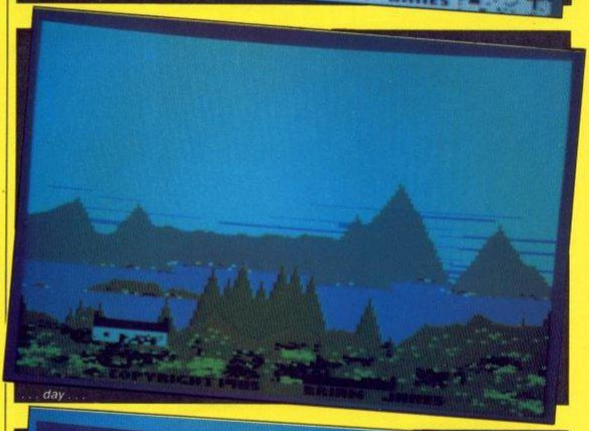
The program needs some "knowledge" about the structure of landscapes, so that the different features will have reasonable shapes and fit sensibly together. Trees and buildings must not hang in mid-air; hills must not have enormous holes through them; land must not be drawn when it is below water! Foreground objects may hide more distant objects — not the reverse — and so on. Distant hills could have a grey or bluish colour; whereas the foreground can have much brighter colours.

Lakes and sea can use a mixture of colours

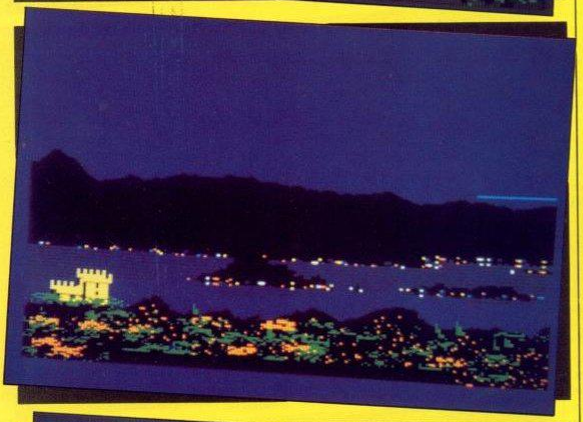
(continued on next page)

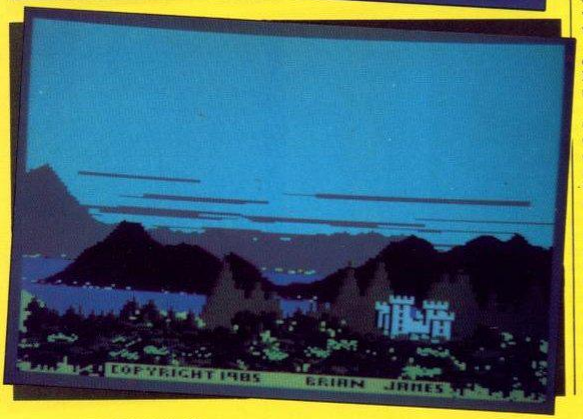


Sunrise . . .


. . . day . . .

. . . sunset





(continued from previous page)

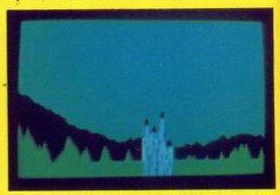
reflecting the hills and sky beyond. The precise formulation of the fundamental properties of a landscape is a subjective process — and this is where the art comes in — and the inspiration for this task came from the Highlands of Scotland and also Cumbria.

The Amstrad version of the program displays several advances compared to the Spectrum version. A tremendous advantage of Amstrad graphics is that any pixel can be any colour. You can have 16 colours in Mode 0, with a resolution of 160 pixels horizontally by 200 vertically. For better resolution, Mode 1 gives you 320 horizontally, but only four colours. I chose Mode 0 with its much greater range of colours. If you want better resolution horizontally than vertically, then you could turn the monitor on its side, and swap your x and y axes.

Pixels can be any colour

Whatever mode you select, any pixel can be any of the available colours. This gives enormous freedom compared to most home computers. Foreground features can be drawn with no effect at all on the background colours. The colours actually used on the screen can be chosen from a selection of 27.

Machine code is notoriously difficult to experiment with and so I am providing a simple program in Amstrad Basic for you to try out. It uses the RND function to generate



a recipe for a mixture of sine waves with different wavelengths and phrases. The sum of all the different waves is a complex curve which can have enormous variability. It is a well-known method called Fourier Synthesis.

Each waveform here is drawn with a different colour and — Hey Presto! — the Fourier Series we learned in stuffy lecture theatres comes to life in brilliant colours.

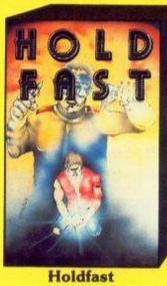
The number of sine waves used in nn. You can try putting in a larger number, say nn = 20 or nn = 50. The curve becomes more and more complex — but very much slower. This method is very good for smooth curves, but becomes too cumbersome and slow for very rough crinkly lines.

Next month we will explore more possibilities with the RND function, and also peer into the fascinating world of "fractals", functions which are particularly suitable for describing the very rough mountain skylines we like to gaze upon.

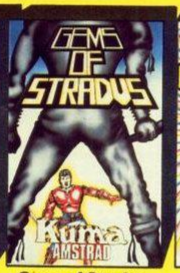
I can supply the Landscape Creator doubly recorded on cassette, for the Amstrad or the Spectrum 48K. Send £5 for the Amstrad version, or £3 for the Spectrum version, to — Brian James, 21 Lamond Place, Aberdeen AB2 3UT. ■

the only choice

Kuma AMSTRAD CPC464 software

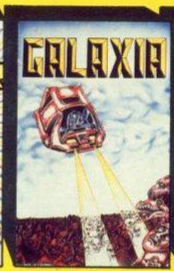


Holdfast



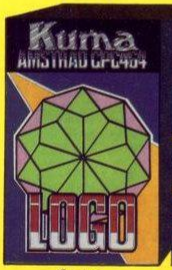
Gems of Stradus

Star Avengers

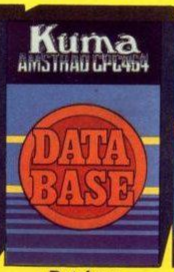


Galaxia

Music Composer

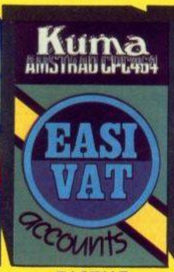


Logo

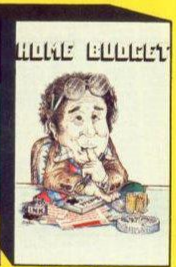


Database

ZEN Assembler



EASIVAT



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JOE AND THE ALLIGATORS

F G Tout and his CBM-64 are on the run.

YOU ARE Joe, out for a quiet boat ride at your favourite beauty spot when you suddenly realise that someone with a warped sense of humour has sent loose a shoal of dangerous and ferocious aligators, intent on making you their snack of the day.

Guide Joe through four waves trying to steer clear of floating logs, other boats, rafts, floating weed and most of all *watch those 'gators.*

When you reach the narrow exit you have to guide Joe through the locks without hitting the walls or overhanging rocks.

There is also a hole in the boat and you must use the fire/button to bale out or the boat will sink.

Time limit and water level are shown at the bottom of the screen:

Time — WHITE
Water level — BLUE

On the locks screen you can control Joe by:

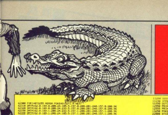
Left — reduce speed of boat
Right — increase speed of boat
Up — increase level of water

Variables.

V — 53248 sprites
Q — sp locations
CO — colour of water level and time limit
TL — time limit
WL — water level
L — joystick port
S1, S2, S3 — sound
SYS 36864 = sound on
SYS 37120 = sound off
LI — lives
LE — lake number
SC — score

Listing 1.

```
10 PRINT"[CLR]":FORT=0TO2:FORX=0TO255:READA:IFA=-1THEN40
20 POKE36864+T*256+X,A:NEXTX
40 NEXTT
[illegible]
29999 FORI=0TO1215:READA:POKE28864+I,A:NEXT
30000 FORI=0TO63:READA:POKE(24*64)+I,A:NEXT
[illegible]
```



Gator: Listing 1.

10 - 200	Music interupt & data
29999-61000	Sprite data
62000-62030	Download W.D.Gs
62155-62235	Sprites for Title
62300-62570	Move sprites.

Gator: Listing 2.

0 - 50	Set variables
100 - 135	Set sprites pos.
600 - 999	Set time and water level
1000- 1099	Main routine
10000-10199	Screen 1
11000-11099	Screen 2
11100-11199	Screen 3
11200-11288	Screen 4
22000-22040	Lives left
23000-23155	Game over
30000-30199	Locks screen
60000-60998	Title page
60999-61199	Music for title page

```
62300 FORI=0TO255:READA:POKE49152+I,A:NEXT
62310 DATA162,0,189,0,208,24,105,5,157,0,208,201,240,157,0,208,96
62320 DATA162,0,189,0,208,24,233,5,157,0,208,201,240,157,0,208,96
62330 DATA162,0,189,1,208,24,233,5,157,1,208,201,240,157,1,208,96
62340 DATA162,0,189,1,208,24,105,5,157,1,208,201,240,157,1,208,96
62350 DATA162,0,189,240,7,24,105,1,201,208,144,2,169,205,157,240,7,232,224
62355 DATA1,208,236,96
62360 DATA162,0,189,240,7,24,105,1,201,211,144,2,169,208,157,240,7,232,224
62365 DATA1,208,236,96
62370 DATA162,2,189,0,208,24,105,1,157,0,208,201,240,157,0,208,96
62375 DATA162,4,189,0,208,24,105,2,157,1,208,201,240,157,0,208,96
62380 DATA162,6,189,1,208,24,233,3,157,0,208,201,240,157,1,208,96
62385 DATA162,8,189,1,208,24,105,4,157,1,208,201,240,157,1,208,96
62390 DATA162,11,189,0,208,24,105,1,157,1,208,201,240,157,0,208,96
62395 DATA162,13,189,0,208,24,233,2,157,1,208,201,240,157,0,208,96
62400 DATA162,14,189,1,208,24,233,2,157,0,208,201,240,157,1,208,96
62410 DATA162,2,189,240,7,24,105,1,201,214,144,2,169,211,157,240,7,232
62420 DATA224,0,208,236,96
62500 FORI=0TO9:READA:POKE49500+I,A:NEXT
62510 FORI=0TO38:READA:POKE49520+I,A:NEXT
62520 DATA173,0,220,32,112,193,32,36,194,96
62530 DATA201,126,208,4,32,34,192,96,201,125,208,4,32,51,192,96,201,123,208,7,32
62540 DATA17,192,32,68,192,96,201,119,208,7,32,0,192,32,91,192,96,96
62550 FORI=0TO24:READA:POKE49700+I,A:NEXT
62560 DATA32,114,192,32,131,192,32,148,192,32,165,192,32,182,192,32,199
62570 DATA192,32,216,192,32,233,192,96
63000 POKE198,2:POKE631,13:LOAD
```

Listing 2.

```
0 S1=54276:S2=54277:S3=54273:FORI=S1-4TOS1+20:POKEI,0:NEXT:POKES1+20,15:GOTO6000
0
1 S1=54276:S2=54277:S3=54273:FORI=S1-4TOS1+20:POKEI,0:NEXT:POKES1+20,15
10 A$="■||||||||||||||||||||||||||||||||||||":POKE53272,31
15 B$="■________________________________"
20 C$="■________________________________"
25 D$="■||||||■■||||||■■||||||■■||||||■■||||||■"
30 E$=" ■|¬¬|¬¬|"
35 F$="■`    ■■■■■■■■`    ■■■■■■■■`    ■■■■■■■■    /■■■■■■"
40 G$="■■■■■■■■■■■■■■■■■■■■■■■■■■■"
50 H$="■■    ■■■■■■■||||■■■■■■■||||■■■■■■■||||■■■■■/____/"
100 V=53248:Q=205:POKEV+21,255:POKEV+28,3:POKEV+37,10:POKEV+38,14:LI=5:SC=0
120 POKEV+29,1:R=0:DEFFNA(A)=(PEEK(V+30)AND1):DEFFNB(B)=(PEEK(V+31)AND1)
130 FORI=40TO46:POKEV+I,12:NEXT:POKEV+3,100:POKEV+0,100:POKEV+9,200:POKEV+10,150
135 POKEV+11,135:POKEV+27,254:POKEV+29,2:POKEV+40,1:CO=54272
500 A0=49500:POKEV+30,0:POKEV+31,0:GOTO10000
600 FORI=1944TO1983:POKEI,72:POKEI+CO,1:NEXT:FORI=1984TO2023:POKEI,72
610 POKEI+CO,4:NEXT:TL=1983:WL=1984:L=56320:QQ=215:IFLI<1THEN23100
999 RETURN
1000 SYSA0:IFFNA(A)=1ORFNB(B)=1THENPOKES1,0:GOTO22000
1010 POKETL,32:POKEWL,72:POKEWL+CO,6:TL=TL-.1:WL=WL+.3:IFPEEK(L)=111THENGOSUB8230
00
1012 IFTL<1945ORWL>2022THEN22000
1099 RETURN
10000 POKE53280,2:POKE53281,3:GOSUB13250:R=0:LE=1
10005 PRINT"■":PRINTB$;D$;A$;C$;"■■■■■■■■■■■■■■■■■■■■■■■■■■■■■";B$;A$;D$;D$:PRINT"■";:PRINTF$
10006 PRINT"■■■■";PRINTG$:PRINT"■■■■":PRINTTAB(31);G$:GOSUB12550:POKEV+21,255
10008 GOSUB600:POKEV+1,170:POKEV,235:POKEV+30,0:POKEV+31,0:R=0:POKE2041,214
10009 GOSUB24000
10010 GOSUB1000:R=R+1:IFR>39THENR=0
10050 IFPEEK(V+1)<45THENSC=SC+(LE*500)+INT(TL)-INT(WL/5):GOTO30000
10110 PRINT"■■■■■";TAB(R);E$;"■■■";TAB(R);E$;"■■■■■";TAB(R);E$
10199 GOTO10010
11000 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■■":POKE53280,2:POKE53281,3:GOSUB13250
11005 PRINT"■`   ♦||||||||||||||||||||||||||||||||||||||"
11006 PRINT"TTT`      ♦■||||||||||||||||||||||||||||||■|"
11007 PRINT"TTT`       ♦■||||||||||||||||||||||||||||■|"
11008 PRINT"TTT`        ♦■||||||||||||||||||||||||||■|"
11009 PRINT"TTT`         ♦■||||||||||||||||||||||||■|"
11010 PRINT"TTT`          ♦■||||||||||||||||||||||■|"
11011 PRINT"TTT`           ♦■||||||||||||||||||||■|"
11012 PRINT"TTT`            ♦■||||||||||||||||||■|"
11013 PRINT"TTT`             ♦■||||||||||||||||■|"
11014 PRINT"TTT`              ♦___________||||||||"
11015 PRINT"TTT`                         ♦■||||||■|"
11016 PRINT"TTT`                         ■■■■||||■|"
11017 PRINT"TTT`                         ■■■■||||■|"
11018 PRINT"TTT`    ■/■     |_________|    ■_■■|||||"
11019 PRINT"TTT`    ■■■    |■||||||||||■`    ■■■■|||||■|"
11020 PRINT"TTT`    ■/■   |■||||||||||■`   ■■ ■|||||■|"
11021 PRINT"TTT`    ■■■ _ ■|■||||||||||■`    ||||||||"
11022 PRINT"TTT`    ■/■ _ _ ■|■||||||||||■`   `■||||||■|"
11023 PRINT"TTT`    ■■■ _ _■ ■||||||||||■`    `■||||||■|"
11024 PRINT"TTT`    ■/ ■_ _■||||||||||||||`   `|||||||"
11025 PRINT"TTT|__________■|||||||||||||■`   `■|||||■|"
11026 PRINT"TTT■|||||||||||||||||||||||■`    `■|||||■|"
11027 PRINT"TTT■|||||||||||||||||||||||`     `|||||||"
11030 GOSUB600:SYS36864:POKEV,40:POKEV+1,210:POKEV+3,126:POKEV+30,0:POKEV+31,0
11039 POKE2041,222:LE=2:GOSUB24000:GOSUB12550:POKEV+28,3:POKEV+21,255
11040 GOSUB1000
11060 IFPEEK(V+1)<43THENSC=SC+(LE*500)+INT(TL)-INT(WL/5):GOTO30000
11099 GOTO11040
11100 POKE53280,2:POKE53281,3:GOSUB13250:LE=3:V=53248:POKEV+28,1:POKEV+21,255
11105 PRINT"■":PRINTB$;D$;A$;C$;"■■■■■■■■■■■■■■■■";D$;A$;D$;D$:POKE2041,223
11106 PRINT"■■■■■■■■■■■■■■■■■■■■";:PRINTF$:PRINT"■■■■■■■■■■■■■■■■■■■■■■";:POKEV+40,5
11107 PRINTTAB(24);F$:PRINT"■■■■":PRINTG$:PRINT"■■■■":PRINTTAB(31);G$:GOSUB12550
11108 PRINT"■■■■■■■■■■";:PRINTTAB(4);H$;"TTTT ";H$;"TTTT ";H$;"TTTT ";H$
11120 GOSUB600:POKEV+1,170:POKEV,235:POKEV+30,0:POKEV+31,0:POKEV+3,155
11139 LE=3:GOSUB24000:GOSUB12550
11140 GOSUB1000
11160 IFPEEK(V+1)<43THENSC=SC+(LE*500)+INT(TL)-INT(WL/5):GOTO10000
11199 GOTO11140
11200 POKE53280,4:POKE53281,3:PRINT"■■":PRINTC$;
11210 FORT=0TO20:PRINT"■                                  \";:NEXT:PRINTB$
11220 PRINT"■■■■":PRINTTAB(4);H$;TAB(13);H$;TAB(22);H$;TAB(31);H$
11225 PRINT"■■":PRINTTAB(31);G$
11230 PRINT"■■■■■■■■■■■■■■■":PRINTTAB(4);H$;"■";TAB(13);H$;TAB(22);H$;TAB(31);H$
11235 PRINT"■":PRINTTAB(13);H$
11240 PRINT"■■■■■■■■■■■■■■":PRINTTAB(11);"■_"TAB(20);"■_"TAB(29);"■_"
11245 PRINT"■■■■":PRINTTAB(20);"■_"
11250 PRINT"■■■■■■■■■":PRINTTAB(7)"■/■__■■/■■■__■■■/■■■■__■■■__■■■/"
11255 POKEV+21,255:PRINT"■■■■■■■■■■■■■■■■■■||||||"
11260 GOSUB600:SYS36864:POKEV,241:POKEV+1,135:POKEV+3,200:POKEV+30,0:POKEV+31,0
11269 POKE2041,222:LE=4:GOSUB24000:GOSUB12550:POKEV+28,3:POKE2040,205
11280 GOSUB1000
11230 IFPEEK(V+1)<43THENSC=SC+(LE*500)+INT(TL)-INT(WL/5):GOTO10000
11289 GOTO11280
12550 PRINT"■";:PRINTTAB(34)SC;:PRINTTAB(74);LI
12555 PRINT"■■■";:PRINTTAB(34);LE:RETURN
13250 POKE2040,205:FORI=5TO15STEP2:POKEV+I,0:NEXT:POKEV+30,0:POKEV+31,0:RETURN
22000 SYS36864+256
22005 D=217:POKES1,16:POKES2,15:FORJ=5TO25:A=A+1:IFA>8THEND=D+1:POKE2040,D:A=0
22010 FORJJ=5TOJSTEP.5:POKES3,JJ:POKES1,33:NEXTJJ,J:POKEV+27,1:POKES1,0
22015 POKES1,128:POKES2,119
22020 X=PEEK(V):Y=PEEK(V+1):POKEV,X:FORT=YTO250STEP5:FORTT=220TO221:POKE2040,TT
22030 POKES1,128:POKEV+1,T:POKES3,250:POKES1,129:FORA=0TO20
22035 NEXTA,TT,T:POKEV+27,0:LI=LI-1:SYS36864:IFLI<1THENGOSUB23100:GOTO60000
22040 ONLEGOTO10000,11000,11100,11200,30000
23000 IFWL<1985THENRETURN
23005 POKEWL,72:POKEWL+CO,4:QQ=QQ+1:IFQQ>216THENQQ=215
23010 WL=WL-1:POKE2040,QQ:RETURN
23100 K$="■■■■■■■■■■■■■           GAME  OVER":POKEV+21,0:POKE53280,11
23140 POKE53281,11:POKES1,16:POKES1+7,32:POKES1+14,32:POKES2,31:POKES2+7,15
23145 POKES2+14,31:SYS36864+256
23150 FORTT=100TO55STEP-4:POKES3,TT:POKES3+7,TT+10:POKES3+14,TT+20:POKES1,17
23151 POKES1+7,33:POKES1+14,33:PRINTK$:POKE646,INT(RND(1)*15):NEXT
23155 PRINTK$:PRINT"           SCORE ";SC:FORT=0TO2500:NEXT:RETURN
24000 PRINT"■■";:PRINTTAB(32)"SC";
24005 PRINT"■■■";:PRINTTAB(32)"LI";
24010 PRINT"■■■";:PRINTTAB(32)"LA"
24020 RETURN
30000 POKE53272,31:CH=14336:U=15496:POKE53280,0:D=1024:W=1200:POKE198,0:FF=255
30005 POKE56331,1
30010 V=53248:FORI=0TO7:POKECH+I+W,FF:NEXT:POKE53281,3
30014 PRINT"■■":POKE53281,0:SYS49900:FORI=1024TO1200:POKEI+CH,0:NEXT
30020 POKE2040,244:X=20:Y=171:POKEV+21,1:POKEV,X:POKEV+1,Y:POKEV+31,0
30050 PRINTTAB(37)"■■■■■||":PRINTTAB(37)"■■ooo":PRINTTAB(37)"■■■|_"
30055 PRINTTAB(37)"■■■ ■■"TAB(34)"■■||■■■ ■■":PRINTTAB(34)"■■oooo■ ■■"
30060 PRINTTAB(34)"■■■||_ ■■":PRINTTAB(30)"■■||■■■|■■oo"
30065 PRINTTAB(30)"■■ooooo■|■■oo":PRINTTAB(22)"■■|||||||■■■||||■■oooo"
30070 PRINTTAB(22)"■■oooooooo■|■■ooooo"
30075 PRINTTAB(10)"■■||||||||||■■■||||||||■■oo■oo■ooo"
30080 PRINTTAB(10)"■■oooooooooooo■|■■■|||■■■■oo■ooo"
30085 PRINTTAB(10)"■■■||____||____/■■■/|||■■■■■■oo■■ooo"
30090 PRINT"■■||||||||■■■■oooo■/■■oooo■■/_/■■■■■oo■■ooo"
30095 PRINT"■■ooooooooooo■■■■■oooooo■■■ooooooo■■ooooo"
30100 PRINT"■■■ ____||| ■■■■■oooooo■■■oooooo■■oooo"
30105 PRINT"■■■■ ■■ooo■/ |■■■ooooooooooooooooooooo"
30110 PRINT"■■■■ ■■ooo■/■■■ooooooooooooooooooooo"
30115 PRINT"■■■oooooooooooooooooooooooooooooo"
30120 PRINT"■■■■■oooooooooooooooooooooooooo■■_|"
30122 PRINT"■■■■■■ooooooooooooooooooooooo■■||/|"
30124 PRINT"■■■■■■■oooooooooooooooooooo■■|||"
30126 PRINT"■■■■■■■■ooooooooooooooooo■■|||"
30127 PRINT"■■■■■■■■■oooooooooooooooo■■|||"
30129 PRINT"■■■■■■■■■■ooooooooooooooo■■|||"
30130 PRINT"■■■■■■■■■■■oooooooooooo■■|||"
30132 PRINT"■■■■■■■■■■■■ooooooooooo______"
30134 PRINT"■■■■■■■■■■■■■oooooooooo■|"
30136 PRINT"■■■■■■■■■■■■■■ooooooo■||"
30138 PRINT"■■■■■■■■■■■■■■■_______■":IFDD=1THENDD=0:RETURN
30139 POKEV+31,0:Z=0:R=56320
30140 POKEV,X+256*(X>255):POKEV+16,(PEEK(V+16)AND253)OR-(X>255):POKEV+1,Y
30150 POKEU,FF:U=U-.3:V=V-.3:POKEV+1,Y:POKEV+31,0:POKEV+30,0:PP=PEEK(R):X=X+2
30155 SC=SC+1:IFPP=123THENX=X-1:V=V-.4:U=U-.4
30157 IFPP=119THENX=X+2:V=V-.2:U=U-.2
30165 IFPP=126THENV=V-.7:U=U-.7
30170 IFFNB(B)=1THENPOKEV+16,0:LI=LI-1:ONLEGOTO10000,11000,11100,11200,10000
30175 IFX>330THENPOKEV+16,0:LI=LI+1:ONLEGOTO11000,11100,11200,10000
30199 GOTO30140
60000 POKE53280,11:POKE53281,0:POKE53272,31:SYS37120:POKE53248+21,0:RESTORE
60001 FORI=54272TO54296:POKEI,0:NEXT:POKE54296,15
60005 POKE53265,PEEK(53265)OR16
60010 V=53248:POKEV+21,31:POKEV+23,255:POKEV+29,255:FORI=39TO46:POKEV+I,13:NEXT
60015 POKEV+28,0:QQ=250:POKEV+27,0:DD=1:PRINT"■":GOSUB30050
60027 PRINT"■■ BY FRANK TOUT  !!!HIT SPACE BAR TO PLAY "
60030 X1=75:X2=125:X3=165:X4=205:X5=245:Y1=255
60032 POKEV,X1:POKEV+2,X2:POKEV+4,X3:POKEV+6,X4:POKEV+8,X5
60035 FORI=1TO9STEP2:POKEV+I,Y1:NEXT:FORI=2040TO2044:QQ=QQ+1:POKEI,QQ:NEXT
60040 FORY1=255TO55STEP-1:POKEV+1,Y1:POKEV+3,Y1:POKEV+5,Y1:POKEV+7,Y1:POKEV+9,Y1
60042 NEXTY1:C=000:A=000:B=000
60045 FORI=39TO46:POKEV+I,13:NEXT
60084 GETX$
60085 POKES1+7,16:POKES1,32:POKES1+14,16:POKES2+14,31
60090 POKES2+7,31:POKES2,15:READA,B,C:POKES3+7,A:POKES3+14,B:POKES3,C
60094 POKES1+7,17:POKES1,33:POKES1+14,17:IFC=000THENRESTORE:GOTO60090
60995 FORT=0TO150:NEXT:IFX$=""THEN60084
60996 IFX$=" "THEN60998
60997 GOTO60084
60998 SYS36864:GOSUB63000:CLR:V=53248:POKEV+23,0:POKEV+29,0:RESTORE
60999 FORI=2042TO2047:POKEI,215:NEXT:GOTO1
61005 DATA5,5,5,10,10,10,5,5,5,10,10,10,5,5,5,10,10,10,5,5,5,10,10,10
61010 DATA5,10,20,20,10,5,5,5,5,10,20,5,5,10,5,5,5,5,5,5,10,10,10,20,20,20
61015 DATA10,10,30,10,20,30,10,50,50,10,60,70,10,40,60,10,30,70,10,20,60,10,10,5
61020 DATA20,30,20,20,30,40,50,40,60,60,60,50,40,30,40,30,20,30,20,10,20,10,5
61025 DATA20,30,40,20,30,40,20,30,40,40,50,60,40,50,60,40,50,60,30,20,10,20,10,5
61030 DATA30,20,30,40,30,40,50,40,60,60,60,50,40,30,40,30,20,30,20,10,20,10,5
61035 DATA10,5
61199 DATA000,000,000
63000 POKE53280,3:POKE53281,3:PRINT"■":POKE53272,31
63010 A1$="■|||||||||||||||||||||||||||||||||||||||"
63015 A2$="■♦     ♦     ♦     ♦     ♦     ♦     ♦"
63020 A3$="■||||||||||||||||||||||||||||||||||||"
63025 A4$="■■oooooooooooox":A5$="■■ooo■|■■■|■■oox":A6$="■|■■■■ |"
63050 PRINT"■":PRINTTAB(33)"■■oooooo":PRINTTAB(32)"■■oooooo"
63055 PRINTTAB(31)"■■oooooooo":PRINTTAB(30)"■■oooooooo"
63060 PRINTTAB(29)"■■ooooooooooo"
63065 PRINTTAB(29);A4$TAB(29);A5$TAB(69);A5$TAB(69)A4$
63070 PRINTTAB(29);A4$TAB(29);A5$TAB(69);A5$TAB(69)A4$
63075 PRINTTAB(7);A3$TAB(8);A2$TAB(40);A2$TAB(47);A3$TAB(48);A2$TAB(80);A2$
63080 FORT=0TO4:PRINTA1$:NEXT:PRINT"TTTTTTTTTTTTT":PRINTTAB(67);A6$
63082 PRINTTAB(7)"■■■■■■"
63084 POKE2040,245:V=53248:POKEV+21,3:POKEV,36:POKEV+1,166:POKEV+28,3
63086 POKEV+37,7:POKEV+38,0:POKEV+39,1:POKEV+23,3:POKEV+29,3:POKEV+27,2
63088 POKE2041,237:POKEV+2,248:POKEV+3,121:POKEV+40,10:X=240
63090 FORT=0TO30:FORZ=246TO250:POKE2041,Z:X=X-1:POKEV+2,X:FORA=0TO20:NEXTA,Z,T
63095 FORY=121TO166:POKEV+3,Y:NEXT
63097 FORX1=36TO2STEP-.2:POKEV,X1:POKEV+2,X1:NEXT:POKEV+23,0:POKEV+29,0:RETURN
```

BBC TANK

Listing 1.

```
10 *LOAD "TANKS-DATA" 4000
20 CHAIN "TANKS-3"
```

Listing 2.

```
  10 REM TANKS-2 BY N.SHEARD
  20 MODE 4
  30 VDU 29,652;524;
  40 MOVE 0,0:LOC%=&4000
  50 FOR Z%=0 TO 2
  60 CLS
  70 PROCdatachasvert
  80 X%=340
  90 RESTORE X%
 100 PROCdrawvert
 110 NEXT Z%
 120 PROCdatachasdiag
 130 X%=390
 140 PROCdrawdiag
 150 CLS
 160 PROCdataturretvert
 170 X%=440
 180 PROCdrawvert
 190 PROCdataturretdiag
 200 X%=480
 210 PROCdrawdiag
 220 CLS
 230 PROCdataenturvert
 240 X%=520
 250 PROCdrawvert
 260 PROCdataenturdiag
 270 X%=560
 280 PROCdrawdiag
 290 FOR CIRC%=0 TO 360 STEP 30:X%=CIRC%*PI/90:A%=44*
COS X%:B%=44*SIN X%:MOVE 0,0:DRAW A%,B%:NEXT
 300 PROCstore
 310 *SAVE "TANKS-DATA" 4000 4948
 320 END
 330 DEFPROCdatachasvert
 340 DATA -1004,8,-4,-7,-5,-8,-6,-8,-7,-7,-7,8,-6,9,-
5,9,-3,7,5,7,5,8,5,-7,6,-8,7,-8,8,-7,8,8,7,9,6,9,5,8,5
,5,-4,5,-4,-4,5,-4,5,-5,-4,-5,-4,-6,5,-6,5,Z%-7,8,Z%-7
,8,Z%-4,5,Z%-4,5,Z%-1,8,Z%-1,8,Z%+2,5,Z%+2,5,Z%+5,8,Z%
+5
 350 DATA -1007,Z%-7,-4,Z%-7,-4,Z%-4,-7,Z%-4,-7,Z%-1,
-4,Z%-1,-4,Z%+2,-7,Z%+2,-7,Z%+5,-4,Z%+5,1500,1500
 360 ENDPROC
 370
 380 DEFPROCdatachasdiag
 390 DATA 1003,9,3,10,2,10,2,11,1,11,-10,0,-10,-1,-9,
-2,-8,-2,3,9,2,8,8,2,10,2,11,1,11,0,1,-10,0,-10,-1,-9,
-1,-8,9,2,7,0,1,6,0,6,-6,0,-6,-1,0,-7,-1,-7,-7,-1,-1,-
7,-2,-7,-7,-2,-7,-1,-9,1,-7,3,-5,1,-3,3,-5,5,-3,7,-1,5
,1,7,-1,9,1000,1,10,-1
 400 DATA 8,-3,6,-1,4,-3,6,-5,4,-7,2,-5,0,-7,2,-9,150
0,1500
 410 ENDPROC
 420
 430 DEFPROCdataturretvert
 440 DATA -1001,-4,2,-4,2,-3,-1,-3,-2,-2,3,-2,3,-1,-2
,-1,-3,0,4,8,4,1,-3,1,-3,2,4,2,3,3,-2,3,-1,4,2,4,1,4,1
,11,0,11,0,4,1500,1500
 450 ENDPROC
 460

 470 DEFPROCdataturretdiag
 480 DATA -1002,-4,-4,-2,-4,-1,-1,-4,-1,-3,-3,-1,-3,0
,0,-3,1,-3,-3,1,-3,2,2,-3,2,-2,-2,2,-2,3,3,-2,3,-1,-1,
3,0,3,3,0,3,1,1,3,2,3,3,2,9,8,8,9,3,3,3,4,7,8,1500,150
0
 490 ENDPROC
 500
 510 DEFPROCdataenturvert
 520 DATA -1001,-4,2,-4,2,-3,-1,-3,-1,-1,-2,-1,-2,-2,
-2,-1,-3,0,-3,2,-1,2,-2,3,-1,3,-1,4,0,4,0,11,1,11,1,4,
2,4,2,2,3,3,3,2,4,2,4,0,2,-2,2,-1,3,-2,1500,1500
 530 ENDPROC
 540
 550 DEFPROCdataenturdiag
 560 DATA -1002,-4,-4,-2,-4,-1,-1,-4,-1,-3,0,-2,0,-3,
2,-3,2,-2,3,-2,3,0,2,0,3,1,3,2,9,8,8,9,3,3,3,4,7,8,2,3
,0,3,0,2,-1,3,-2,3,-2,2,-3,2,-3,0,-2,0,-3,-1,1500,1500
 570 ENDPROC
 580
 590 DEFPROCdrawvert
 600 REPEAT:READ A%,B%:IF A%=1500 THEN GOTO 620
 610 PROCdraw
 620 UNTIL A%=1500:PROCstore:RESTORE X%:CLS:MOVE 0,0
 630 REPEAT:READ A%,B%:IF A%=1500 THEN GOTO 670
 640 IF A%>1000 THEN A%=A%-1000:C%=A%:A%=B%:B%=C%:A%=
A%+1000:PROCdraw:UNTIL FALSE
 650 IF A%<-1000 THEN A%=A%+1000:C%=A%:A%=B%:B%=C%:A%
=A%-1000:PROCdraw:UNTIL FALSE
 660 C%=A%:A%=B%:B%=C%:PROCdraw
 670 UNTIL A%=1500:PROCstore:RESTORE X%:CLS:MOVE 0,0
 680 REPEAT:READ A%,B%:IF A%=1500 THEN GOTO 700
 690 A%=A%*-1:B%=B%*-1:PROCdraw
 700 UNTIL A%=1500:PROCstore:RESTORE X%:CLS:MOVE 0,0
 710 REPEAT:READ A%,B%:IF A%=1500 THEN GOTO 750
 720 IF A%>1000 THEN A%=A%-1000:C%=A%:A%=B%:B%=C%:A%=
```

TANKS IS an arcade-style game for the BBC Micro with operating system OS 1.2. The program features machine-code, flicker-free, high-resolution graphics, with independent rotation of the tanks' turrets and chassis, music, animated lives and a high-resolution title page.

To get the program Saved on tape, first type in listing 1 and Save it as Tanks-1, then type in listing 2 and Save it as Tanks-2 on a different tape. Run Tanks-2 and a series of rotations of tank's chassis, turrets and trees will appear on the screen followed by the message "Record then return".

Start your tape recording straight after Tanks-1 and press Return. Finally, type in listing 3 and Save it as Tanks-3 after Tanks Data. To load the game

CHAIN "TANKS-1"

which will draw the title page and automatically load the other sections.

When the whole program has loaded, the instructions will be displayed. The object of the game is to destroy all enemy tanks — those with crosses on their turrets — by cleverly chasing and ambushing them. You score 100 points for each tank destroyed and 1,000 points for each screen completed.

After losing a life or on starting a new game your tank automatically drives from the barracks, at the top right of the screen, to the centre of the screen ready for action, during which the music plays. At the end of the game the last score and the highest score are displayed.

In writing the game the first problem was that, to obtain the necessary independence of rotation of a tank's chassis and turret, a total of 128 3-by-3 character matrices had to be defined, or 1,152 characters, or 9,216 numbers would have had to be typed in. This is obviously a massive waste of memory and would be very prone to error.

The alternative was to separate the turret and chassis into different characters and overlay one of the eight different rotations of each on to the other. This can be done using the Basic function Or, which affects the bits of two numbers when written in binary such that:

0101010 0 OR 00110101 = 01110101

It can be seen from this that if there is a 1 in any or both of the corresponding positions of the numbers then a 1 will appear in the corresponding position in the answer. Only where there is an 0 in both of the corresponding positions of the numbers does an 0 appear in a corresponding position in the answer. Thus:

8 OR 53 = 117

Unfortunately, using Or is too slow to produce flicker-free graphics and so I wrote a machine-code subroutine which appears at line 1940 in listing 3. ORA is the equivalent function to Or in assembly language and takes the form:

LDA (first number):
ORA (second number):
STA (on screen)

As you can see I have directly accessed the screen for ease and speed and so second processors must be disconnected before running the program.

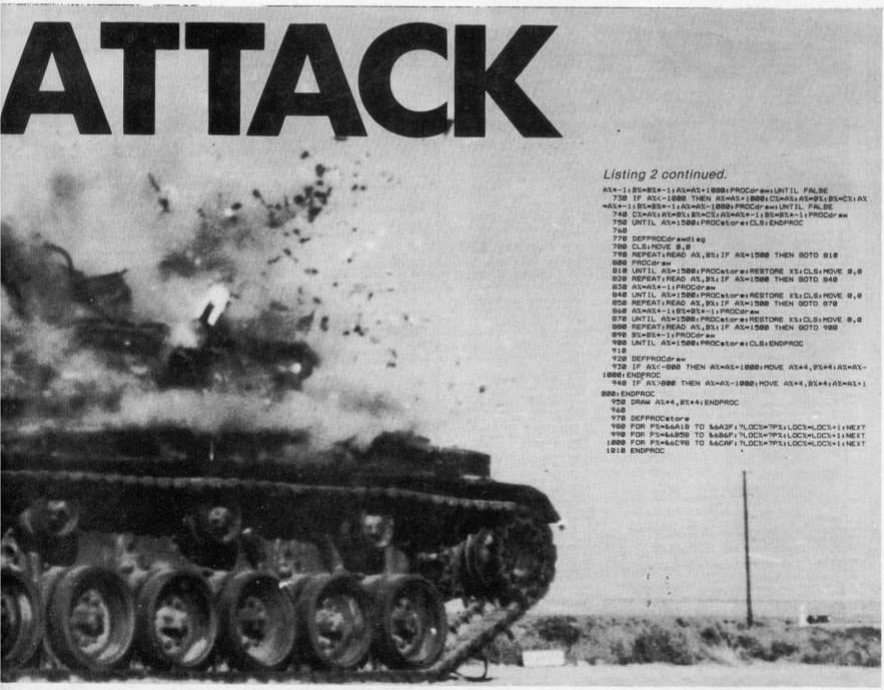
With the program altered to accept this only 24 3-by-3 character matrices are required, that is 1,728 numbers to be typed in, which is still too prone to error. The solution was simple, use the BBC's processing power to rotate the shapes — from just two of the most important rotations of each shape entered from the keyboard — to create the remaining rotations and store them in the memory before the game begins. Listing 2 does this by reflecting the shapes in varying lines.

With this entered and working correctly only six of the 128 3-by-3 character matrices that will appear on the screen have to be defined.

If you wish to have a copy of the game, but do not have the time to type it in, it is available from N Sheard, 2 Ashbrook Drive, Prestbury, Cheshire SK10 4BY, on cassette for £4 including P&P.

(continued on next page)

ATTACK



Listing 2 continued.

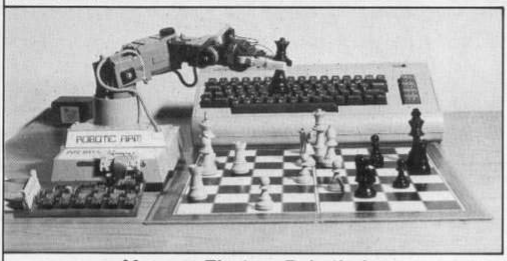
```
AX=-1:BX=BX-1:AX=AX+1000:PROCdraw:UNTIL FALSE
  730 IF AX<-1000 THEN AX=AX+1000:CX=AX:AX=BX:BX=CX:AX
=AX-1:BX=BX-1:AX=AX-1000:PROCdraw:UNTIL FALSE
  740 CX=AX:AX=BX:BX=CX:AX=AX-1:BX=BX-1:PROCdraw
  750 UNTIL AX>1500:PROCstore:CLS:ENDPROC
  760
  770 DEFPROCdrawdiag
  780 CLS:MOVE 0,0
  790 REPEAT:READ AX,BX:IF AX<1500 THEN GOTO 810
  800 PROCdraw
  810 UNTIL AX>1500:PROCstore:RESTORE X%:CLS:MOVE 0,0
  820 REPEAT:READ AX,BX:IF AX<1500 THEN GOTO 840
  830 AX=AX-1:PROCdraw
  840 UNTIL AX>1500:PROCstore:RESTORE X%:CLS:MOVE 0,0
  850 REPEAT:READ AX,BX:IF AX<1500 THEN GOTO 870
  860 AX=AX-1:BX=BX-1:PROCdraw
  870 UNTIL AX>1500:PROCstore:RESTORE X%:CLS:MOVE 0,0
  880 REPEAT:READ AX,BX:IF AX<1500 THEN GOTO 900
  890 BX=BX-1:PROCdraw
  900 UNTIL AX>1500:PROCstore:CLS:ENDPROC
  910
  920 DEFPROCdraw
  930 IF AX<-800 THEN AX=AX+1000:MOVE AX*4,BX*4:AX=AX-
1000:ENDPROC
  940 IF AX>800 THEN AX=AX-1000:MOVE AX*4,BX*4:AX=AX+1
000:ENDPROC
  950 DRAW AX*4,BX*4:ENDPROC
  960
  970 DEFPROCstore
  980 FOR P%=&6A10 TO &6A2F:?LOCX=?P%:LOCX=LOCX+1:NEXT
  990 FOR P%=&A8D0 TO &A8AF:?LOCX=?P%:LOCX=LOCX+1:NEXT
 1000 FOR P%=&6C90 TO &6CAF:?LOCX=?P%:LOCX=LOCX+1:NEXT
 1010 ENDPROC
```

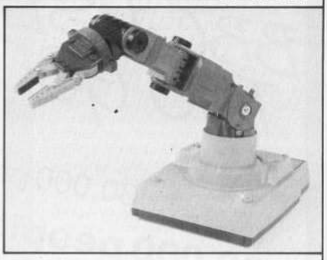
(continued from previous page)

Listing 3.

```
10 REM TANKS-3 BY N.SHEARD
20 ON ERROR GOTO 50
30 HIT=0
40 SCORE=0
50 MODE 7:VDU 23;8202;0;0;0;
60 PROCinstructions
70 MODE 4:VDU 23;8202;0;0;0;
80 VDU 19,1,0,0,0,0:VDU 19,0,3,0,0,0
90 LIVES=4
100 PROCmachinecode
110 RESTORE:PROCdata
120 PROCnewlife
130 GOTO 160
140 RESTORE:PROCdata
150 PROCdraw
160 GX=20:HX=14
170 TURX=8:CHASX=8:ROTX=1
180 TURY=TURX:CHASY=8:ROTY=1
190 PROCgame
200 IF ?65808=0 AND ?65809=0 AND ?65840=0 AND ?65849
=0 SCORE=SCORE+1000:RESTORE:PROCdata:CLS:GOTO140
210 GOTO 190
220
230 DEFPROCdraw
240 XW=(GX*72)+64000:BX=(GX*72)+64000
250 EX=(GX+32)-(CX*8)+65000:?672=EX MOD 256
260 ?674=AX MOD 256:?675=AX DIV 256
270 ?676=BX MOD 256:?677=BX DIV 256
280 ?672=EX MOD 256:?673=EX DIV 256
290 CALL control
300 ENDPROC
310
320 DEFPROCcheck
330 EX=(GX+32)-(CX*8)+65000
340 ?672=EX MOD 256:?673=EX DIV 256
350 CALL check
360 ENDPROC
370
380 DEFPROCclear
390 EX=(GX+32)-(CX*8)+65000
400 ?672=EX MOD 256:?673=EX DIV 256
410 CALL blank
420 ENDPROC
430
440 DEFPROCdata
450 DATA 0,12,1,15,2,14,3,13
460 FOR I%=65800 TO 65807:READ X%:?I%=X%:NEXT
470 DATA 16,28,17,23,18,22,19,21
480 FOR I%=65810 TO 65817:READ X%:?I%=X%:NEXT
490 DATA 24,28,25,31,26,30,27,29
500 FOR I%=65820 TO 65827:READ X%:?I%=X%:NEXT
510 DATA 8,134,162,99,166,144,12,86,208,0,182,238,96
,0
520 MEM%=&4200
530 FOR X%=1 TO 14:READ P%:A%=128
540 REPEAT:IF !A% AND P% THEN THEN%=1 ELSE THEN%=0
550 A%=A% DIV 2:MEM%=MEM%+(1*THEN%):A%=A%*NEXT X%
560 VDU 23,224,85,170,85,170,85,170,85,170
570 VDU 23,225,0,0,0,0,255,0,0,0
580 VDU 23,226,0,0,0,0,24,24,0,0,0
590 DATA 1,1,0,0,1,0,2,2,25,1,1,4,4,10,2,2,5,1,1,0,0,
18,2,35,0,1,1,0,0,18,2,35,27
600 FOR I%=65830 TO 65847:READ X%:?I%=X%:NEXT
610 REPEAT:?(?(65830+(INT(RND(4))-1)*8)=RND(INT(RND(
)*.2
620 FOR I%=65840 TO 65879:?I%=8:NEXT
630 DATA 13,6,13,6,13,6,21,12,29,6,33,6,49,12,49,6,4
1,6,33,6,21,12,33,6,13,12,13,6,13,6,13,6,21,12,29,6,33
,6,49,12,49,6,41,6,33,6,21,0,33,6,13,24,1,1
640 LOCX=65780:REPEAT:READ A%,B%:?LOCX=A%:?(LOCX+1)=
B%:LOCX=LOCX+2:UNTIL A%=0
650 ENDPROC
660
670 PROCfiends
680 TRACKX=TRACKY=4:IF TRACKX=14 TRACKX=2
690 IF ROTX=1 DUMX=BUMX:-1 ELSE DUMX=BUMX+1
700 IF DUMX>5 ROTX=1
710 IF DUMX<3 ROTX=0
720 IF LIVES=1 GOTO 748
730 A%=?(65810+DUMX)+72+64000:?674=A% MOD 256:?675
=A% DIV 256:B%=?(TRACKX+72)+64000:?676=B% MOD 256:?677=
B% DIV 256:?680=LIVES:CALL live
740 CX=65:DX=65
750 CHASX=CHASX-(INKEY(-67)+(INKEY(-98)
760 TURX=TURX-(INKEY(-67)+(INKEY(-98))
770 TURX=TURX-(INKEY(-105)+(INKEY(-104))
780 IF TURX<8 TURX=7
790 IF TURX>7 TURX=8
800 IF CHASX<8 CHASX=7
810 IF CHASX>7 CHASX=8
820 A%=?(CHASX+65808):B%=?(TURX+65810)
830 FILL:CALL FILYSWAP
840 IF INKEY(-99) AND CHASX<8 THEN DX=DX-1
850 IF INKEY(-99) AND CHASX>2 THEN DX=DX+1
860 IF INKEY(-98) AND CHASX<8 THEN CX=CX-1
870 IF INKEY(-98) AND CHASX>6 THEN CX=CX+1
880 VARX=CX:VARY=DX
890 CX=FILX:DX=FILYS
900 PROCclear
910 CX=VARX:DX=VARYS
920 PROCcheck
930 IF ?679=0 CX=BX:DX=HX ELSE BX=CX:HX=DX
940 PROCdraw
950 IF INKEY(-1) AND TURX MOD 2=8 THEN GOTO 960:ELSE
GOTO 970
960 F%=65870:IF ?F%=0 GOTO 970
970 F%=65874:IF ?F%=0 GOTO 980 ELSE ENDPROC
980 ?F%=?(F%+1)=TURX:?(F%+2)=GX:?(F%+3)=HX:?(F%+4)=
F%:PROCcheck:?(CX*?(F%+2)+DX+(F%+3)):PROCcheck:GOTO
DUMX 0,-15,4,2
990 IF ?679=0 TF%=0
1000 ENDPROC
1010
1020 DEFPROCscreen
1030 MEM%=&4200
1040 FOR X%=4 TO 28 STEP 3:FOR X%=2 TO 35 STEP 3:IF ?
MEM%=1 A%=?(BX+33):CX=X%:DX=Y%:PROCdraw
1050 MEM%=MEM%+1:NEXT X%:NEXT Y%
1060 FOR Y%=8 TO 28:PRINTTAB(Y%,0);CHR$(224);NEXT
1070 FOR X%=8 TO 29:PRINTTAB(0,A%);CHR$(224);CHR$(224
);PRINTTAB(38,A%);CHR$(224);CHR$(224):NEXT
1080 FOR A%=8 TO 38:PRINTTAB(A%,3);CHR$(224):NEXT
1090 FOR A%=%7680 TO %7FFF STEP 2:?A%=B%:?(A%+1)=?B%
:NEXT
1100 FOR A%=8 TO 2:PRINTTAB(26,A%);CHR$(224);CHR$(224
);CHR$(224):NEXT
1110 PRINTTAB(29,3);CHR$(225);CHR$(225);CHR$(225);PRI
NTTAB(0,30);CHR$(224);CHR$(224)
1120 PRINTTAB(5,2);"SCORE";?SCORE;PRINTTAB(15,1);"HI-
SCORE";!HI
1130 IF LIVES>4 GOTO1158
1140 CX=29:FOR VAR%=8 TO LIVES-1:A%=2:B%=18:CX=29+VA
R%:DX=B%:PROCclear:NEXT
1150 IF LIVES>0 GOTO1168
1160 CX=29:FOR VAR%=8 TO LIVES-2:A%=2:B%=18:CX=29+VA
R%:DX=B%:PROCclear:NEXT
1170 ENDPROC
1180
1190 DEFPROCmenuyesnoke
1200 FOR I%=65838 TO 65844 STEP 8
1210 ENX%=?(I%+6):ENY%=?(I%+7)
1220 IF ?I%=8 NEXT I%:ENDPROC
1230 PROCsearch
1240 CX=ENX%:DX=ENY%
1250 PROCclear
1260 IF ?(I%+4)>18 GOTO 1310
1270 ?(I%+2)=8 THEN CX=DX-1
1280 IF ?(I%+2)=2 THEN CX=CX-1
1290 IF ?(I%+2)=4 THEN DX=DX+1
1300 IF ?(I%+2)=6 THEN CX=CX-1
1310 PROCcheck:IF ?679=0 ?(I%+4)=CX:?(I%+7)=DX ELSE C
X=ENX%:DX=ENY%:?(I%+4)=CX:?(I%+7)=DX
1320 A%=?(65808+?(I%+2)):B%=?(65820+?(I%+3))
1330 PROCclear
1340 ?679=0
1350 A%=?(I%+2):B%=?(I%+3):I=A%+65808
1360 IF ?(I%+3) MOD 2=8 AND ?A%=0 AND RND(1)>.2 ?A%=1
?(I%+4)=?(I%+2):?(I%+5)=?(I%+3):?(I%+6)=?(I%+7)
?(I%+7)=?(I%+3):PROCmovehavehit:PROCmovehavehit:?(I%+2)=
?(I%+4):?(I%+3)=?(I%+6):PROCcheck:SOUND 8,-15,6,2
1370 IF ?679=1 ?A%=0
1380 NEXT I%:ENDPROC
1390
1400 DEFPROCsearch
1410 ?(I%+3)=?(I%+3)-DUN%:-4
1420 IF ?(I%+4)=10 AND (ENX%-2) MOD 3=8 AND (ENY%-1)
MOD 3=8 THEN PROCdirection
1430 IF ?(I%+4)>18 ?(I%+2)=?(?(I%+2)+1):?(I%+3)=?(?(I%+3)-
1):?(I%+4)=?(?(I%+4)-1)
1440 IF ?(I%+4)<18 ?(I%+2)=?(?(I%+2)-1):?(I%+3)=?(?(I%+3)
+1):?(I%+4)=?(?(I%+4)+1)
1450 IF ?(I%+4)=8 OR ?(I%+4)=100 ?(I%+4)=10
1460 IF ?(I%+3)>250 ?(I%+3)=7
1470 IF ?(I%+3)>7 ?(I%+3)=?(I%+3)-8
1480 IF ?(I%+3)<250 ?(I%+3)=8
1490 IF ?(I%+3)<7 ?(I%+3)=8
1500 ENDPROC
1510
1520 DEFPROCdirection
1530 CX=ENX%:DX=ENY%:EX=(DX+32)+(CX*8)+65000:?672=EX
MOD 256:?673=EX DIV 256
1540 CALL check:VARX=?679
1550 IF VARX=0 ENDPROC
1560 IF VARX=1 GOTO 1590
1570 IF VARX=1:DIRX=-1:REPEAT:DIRY=DIRX:-1:IF DIRX=4 T
HEN ENDPROC
1580 UNTIL ?(DIRX+65808)=1:PROCnewdirect:ENDPROC
1590 A%=?(I%+2)-4:IF A%>7 A%=A%-8
1600 ?(I%+2)=A%:?(I%+3)=?(I%+3)-8
1610 A%=INT(RND(4)+65847:IF ?(A%)=1 DIRX=(A%-65858):
PROCnewdirect:ENDPROC ELSE GOTO1610
1620
1630 DEFPROCnewdirect
1640 A%=?(I%+2)/2
1650 IF A%=DIRX=2 OR DIRX=A%=2 ?(I%+4)=4:ENDPROC
1660 IF A%=8 AND DIRX=8 ?(I%+4)=1:ENDPROC
1670 IF A%=8 AND DIRX=6 ?(I%+4)=2:ENDPROC
1680 IF A%=DIRX8 ?(I%+4)=2:ENDPROC
1690 IF A%=DIRX6 ?(I%+4)=1:ENDPROC
1700 ENDPROC
1710
1720 DEFPROCgame
1730 TIME=0
1740 PROCshell
1750 PROCdamageyhell
1760 PROCcrash
1770 PROCdamageyhell
1780 PROCdamageyhell
1790 PROCdamageyhell
1800 REPEAT:UNTIL TIME>35
1810 PRINTTAB(5,2);"SCORE";!SCORE;
1820 IF SCORE>!HI HI=SCORE
1830 PRINTTAB(5,1);"HI-SCORE";!HI
1840 ENDPROC
1850
1860 DEFPROCmachinecode
1870 FOR pass=0 TO 2 STEP 2
1880 P%=&5100
1890 [
1900 OPT pass
1910 .move
1920 LDY #&18
1930 .loop
1940 LDA(&70),Y:DRA(&72),Y:STA(&72),Y:DY#&8:BNE l
oop:RTS
1950
1960 .control
1970 LDA &74:STA &70:LDA &75:STA &71:JSR movel:LDA &7
6:STA &70:LDA &77:STA &71:JSR movel:LDA &74:CLC:ADC #&1
8:STA &74:LDA &75:ADC #&0:STA &75:LDA &76:CLC:ADC #&18
:STA &76:LDA &77:ADC #&0:STA &77:LDA &72:CLC:ADC #&18:S
TA &72
1980 LDA &73:ADC #&1:STA &73
1990 LDA &70:STA &78:LDA &75:STA &71:JSR movel:LDA &76
:STA &70:LDA &77:STA &71:JSR movel:LDA &74:CLC:ADC #&18
:STA &74:LDA &75:ADC #&0:STA &75:LDA &76:CLC:ADC #&18:
STA &76:LDA &77:ADC #&0:STA &77:LDA &72:CLC:ADC #&18:S
TA &72
2000 LDA &73:ADC #&1:STA &73:LDA &74:STA &78:LDA &75:
STA &79:JSR movel:LDA &76:STA &78:LDA &77:STA &79:JSR m
ovel:RTS
2010
2020 .blank
2030 LDX #&3
2040 .clout
2050 LDY #&0
2060 .b_loop
2070 DEY:LDA #&0:STA (&72),Y:CPY #&8:BNE b_loop:DEX:C
PX #&1:BNE exit:LDA &72:CLC:ADC #&40:STA &72:LDA &73:A
DC #&1:STA &73:JMP clout
2080 .exit:RTS
2090
2100 .check
2110 LDX #&3
2120 .c_count
2130 LDY #&18
2140 .c_loop
2150 DEY:LDA (&72),Y:BNE found:CPY #&0:BNE c_loop:DEX
:CPX #&0:BNE c_count:LDA &72:CLC:ADC #&40:STA &72:LDA &
73:ADC #&1:STA &73:JMP c_count
2160 .found:LDA #&1:STA &79:RTS
2170 .found:LDA #&1:STA &78:RTS
2180
2190 .shellcheck
2200 LDY #&8
2210 .s_loop
2220 DEY:LDA (&72),Y:BNE s_found:CPY #&0:BNE s_loop:L
DA #&0:STA &78:RTS
2230 .s_found:LDA #&1:STA &78:RTS
2240
2250 .buffer
2260 LDX #25&:LDA #&00:JSR &FFF4:STX &79:RTS
2270
2280 .tankcheck
2290 LDA #&1:STA &79:LDX &7C:BEC:SBC #&C8:STA &72:LDA
&7D:SBC #&3:STA &73:JSR check:JSR block:LDA &78:STA &5
B
2300 LDA &7C:BEC:SBC #&18:STA &72:LDA &7D:SBC #&18:STA
&73:JSR check:JSR block:LDA &78:STA &5B53
2310 LDA &7C:CLC:ADC #&C8:STA &72:LDA &7D:ADC #&3:STA
&73:JSR check:JSR block:LDA &78:STA &5B52
2320 LDA &7C:CLC:ADC #&18:STA &72:LDA &7D:ADC #&18:STA
&73:JSR check:JSR block:LDA &78:STA &5B51:RTS
2330
2340 .block
2350 LDA &78:BEQ nought:LDA #&8:STA &78:RTS
2360 .nought:LDA #&1:STA &78:LDX &7B:INX:STX &79:RTS
2370
2380 .movehell
2390 LDY #:LDA(&78),Y:CMP #5:BMI .right:LDY #2:LDA (
&78),Y:STA &73:DEC &73:LDA &73:STA (&78),Y
2400 .right:LDY #1:LDA(&78),Y:CMP #&4:BPL .up:CMP #&8
:BPL .down:LDY #2:LDA(&78),Y:STA &73:INC &73:LDA &73:STA(&7
8),Y
2410 .up:LDY #1:LDA(&78),Y:CMP #2:BMI movecup:CMP #&3
:BPL .movedown:JMP .down
2420 .movedown:LDY #3:LDA(&78),Y:STA &73:DEC &73:LDA &7
3:STA(&78),Y
2430 .movecup:LDY #1:LDA(&78),Y:CMP #3:BMI endcMP:LDY
L.end:LDY #3:LDA(&78),Y:STA &73:INC &73:LDA &73:STA(&7
8),Y
2440 .endcRTS
2450
2460 .lives
2470 LDA #1:STA &7C:LDA &75:STA &70:LDA &76:STA &71:
LDA &77:STA &79
2480 LDA #&8:STA &72:LDA #&58:STA &73:JSR blank:LDA
&74:LDA &72:STA &5D:STA &7A:LDA &73:JSR control:LDA &7C:STA
2490 LDA #&8:STA &72:LDA noliveslDA #&0:STA &73:JSR
&9F control:RTS
2500 .noliveslRTS
2510 ]
2520 NEXT
2530 ENDPROC
2540
2550 DEFPROCexplosion
2560 XS=%32+&0:YS=1823-(DX*32+&8)
2570 SOUND 8,-15,0,10:SOUND 8,-15,5,15:SOUND 8,-8,5,
2580 FOR I%=0 TO 2
2590 FOR CIRCLE=0 TO 500 STEP 60
2600 MOVE:PLOT 4,XS+X%+20*COS(RAD(N%)):BSVY%=(
58*SIN(RAD(N%)))+YS:MOVE XS,YS:PLOT 6,XS+X%,YS:MOVE
XS-(X%-&5):BSVY%=(BS-YS)+PLOT 6,A%,B%:NEXT
2610 NEXT LOOP
2620 PROCclear
2630 ENDPROC
2640
2650 DEFPROCnewshell
2660 IF ?(I%+2)=8 AND ?A%=0 GOTO 2680 ELSE 4
2670 IF ?I%=8 NEXT:ENDPROC
2680 NEWCIRCLE%=?(I%+2):?(I%+2)=?(I%+2)+7
2690 PROCcrashed
2700 IF ?(I%+2)=2 AND ?(I%+2)=?(I%+2) AND HX<=?(I%+3)
AND HX>=?(I%+3) CX=DX:DX=HX:PROCexplosion:GOTO 118
0:ELSE IF ?(I%+2)=DX+?(I%+3) PROCshellcheck:IF ?679=1
?(I%+2)=NEWCIRCLE%
2720 PRINTTAB(?(I%+2),?(I%+3));CHR$(226):NEXT:ENDPROC
2730
2740 DEFPROCshellcheck
2750 EX=(DX+32)+(CX*8)+65000:?672=EX MOD 256:?673=EX
DIV 256:CALL shellcheck:ENDPROC
2760
2770 DEFPROCnewshell
2780 ?679=1:?A%=0:?I%=I% MOD 256:CALL movehell
2790 ENDPROC
2800
2810 DEFPROCnewlife
2820 ?679=0:?A%=0
2830 IF LIVES>1 THEN PRINTTAB(15,1);"GAME OVER":TIM
E=0:REPEAT UNTIL TIME>300:GOTO50 ELSE CLS:PROCscreen:L
IVES=LIVES-1
2840 DATA 5,29,29,13,6,29,13,6,29,13,6,29,13,5,2
6,13,4,26,14,5,26,15,4,26,16,5,26,16,6,26,16,7,26,16,8
,26,16
2850 LOCX=65780
2860 FOR DX=0 TO 12:CX=29:A%=?(DX+65810):PROCdraw:TIME=0
:REPEAT:CALL buffer:IF?679=0 AND ?LOCX=?(DX+65810-1)+5
LOCX,?(LOCX+1)=SOUND 1,0,0,2:LOCX=LOCX+2:UNTIL TIME>37
:PROCclear:NEXT ELSE UNTIL TIME>37:PROCclear:NEXT
2870 FOR I%=0 TO 2:A%=?(I%+65840):CX=?(I%+65848):DX=?
(I%+65856):PROCdraw:TIME=0:REPEAT:CALL buffer:IF?679=0
AND ?LOCX=?(A%+2)+5 SOUND 1,-15,?LOCX,?(LOCX+1)+2:SOUND
2,0,?(LOCX+1)+2:LOCX=LOCX+2:UNTIL TIME>37:PROCclear:NEXT
TIME>37:PROCclear:NEXT
2880 FOR CX=26 TO 21 STEP -1:DX=16:A%=3:B%=19:PROCdra
w:TIME=0:REPEAT:CALL buffer:IF?679=4 AND ?LOCX(>) SOUN
D 1,-15,?LOCX,?(LOCX+1)+2:SOUND 2,0,?(LOCX+1)+2:SOUND
1,0,?(LOCX+1)+2:LOCX=LOCX+2:UNTIL TIME>40:PROCclear:
NEXT
2890 FOR I%=1 TO 2:READ A%,CX,DX:PROCdraw:TIME=0:REP
EAT:CALL buffer:IF?679=4 AND ?LOCX(>) SOUND 1,-15,?LOCX
,?(LOCX+1)+2:SOUND 2,0,?(LOCX+1)+2:LOCX=LOCX+2:UNTIL
TIME>40:PROCclear:NEXT ELSE UNTIL
2900 FOR CX=26 TO 21 STEP -1:DX=16:A%=3:B%=19:PROCdr
aw:TIME=0:REPEAT:CALL buffer:IF?679=4 AND ?LOCX(>) SOUN
D 1,-15,?LOCX,?(LOCX+1)+2:SOUND 2,0,?(LOCX+1)+2:SOUND
1,0,?(LOCX+1)+2:LOCX=LOCX+2:UNTIL TIME>40:PROCclear:
NEXT
2910 ?679=0:?A%=0:?I%=I% MOD 256:CALL movehell:RTS
2920 DEFPROCcrash
2930 FOR CX=&5B75 TO &5B77 STEP &1:IF ?CX=0 NEXT:ENDP
OC
2940 IF DX(>?(I%+2) AND DX>3?(I%+2) AND HX(>?(I%+3)
AND HX>3?(I%+3):GOTO 2950 ELSE PRINTTAB(?(I%+2),?(I%+
3));" "
2950 PROCcrashed
2960 FOR L%=&5B4F TO &5B4F STEP B:?L%=&1:?(L%+2)
AND ?(L%+6)=?(I%+2) AND ?(L%+7)=?(I%+3) AND ?(L%+
1)=2+?(I%+2) AND ?L%=1 CX=?(L%+6):DX=?(L%+7):PROCexpl
osion:GOTO&5B0:NEXT:?(L%+6)=?(L%+7)=0:?(L%+1)=0:?L%=0:
NEXT L%
2970 CX=?(I%+2):DX=?(I%+3):PROCshellcheck:IF ?679=1 ?
I%=NEXT:ENDPROC
2980 IF ?I%=1 PRINTTAB(?(I%+2),?(I%+3));CHR$(226):NEX
T:ENDPROC
2990 NEXT:ENDPROC
3000
3010 DEFPROCinstructions
3020 PRINTTAB(9,2);CHR$(131);CHR$(141);"TANKS by N.Sh
eard":PRINTTAB(9,3);CHR$(131);CHR$(141);"TANKS by N.Sh
eard"
3030 PRINTTAB(9,4);CHR$(136);CHR$(146);"
"
3040 PRINTTAB(5,7);CHR$(134);"SCORE";!SCORE;PRINTTAB
(23,7);"HI-SCORE";!HI
3050 PRINTTAB(11,10);CHR$(131);CHR$(141);"INSTRUCTION
S";PRINTTAB(11,11);CHR$(131);CHR$(141);"INSTRUCTIONS";
3060 PRINTTAB(9,14);CHR$(136);CHR$(146);"
"
3070 PRINTTAB(8,16);CHR$(134);"Z -ROTATE CHASSIS LEF
T.";PRINTTAB(8,17);CHR$(134);"X -ROTATE CHASSIS RIGHT
";PRINTTAB(8,18);CHR$(134);"<,> -ROTATE TURRET LEFT.";
PRINTTAB(8,19);CHR$(134);"/ -ROTATE TURRET RIGHT.";
3080 PRINTTAB(8,20);CHR$(134);"space bar -ACCELERA
3090 PRINTTAB(8,21);CHR$(134);"shift -FIRE.";
3100 PRINTTAB(4,23);CHR$(136);CHR$(131);CHR$(157);CHR
$(134);"PRESS ANY KEY TO START ";CHR$(158)
3110 ]
3118 TIME=0:REPEAT UNTIL TIME>100:G=GET:SCORE=0:ENDP
ROC
3120 END
```

Make more things happen with Memoco.





Memoco Electron Robotic Arm

12 Axis of movement. Arm raise and lower. 270 degree rotation left or right. 90 degree elbow movement left or right. 90 degree wrist movement either side of centre. 270 degree wrist rotation in either direction.
Claw open and close.
Fitted with motor control circuit. Switched from 5 volt TTL. Controlled by computer. Separate motor driver power supply.

With position feedback _____ **£129.95**
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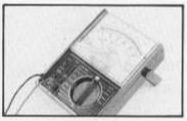

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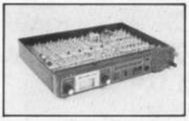
Our Price _____ **£15.45**



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A.A., C., D and PP3.
Charges up to five batteries at a time.

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Mains to DC regulated 300mA 6v, 7.5v, 9v selectable. Suitable for most battery operated equipment.

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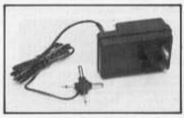

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3 distribution strips with 300 tie points.
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High quality U.L. approved. Sockets including Strain Relief

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IDC 40 way	£3.00	£3.45
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Plugs

Please state whether straight or right angle.

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IDCP 16 way	£1.09	£1.25
IDCP 20 way	£1.22	£1.40
IDCP 26 way	£1.52	£1.75
IDCP 34 way	£1.78	£2.05
IDCP 40 way	£1.91	£2.20
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20 way	£0.26	£0.30
24 way	£0.31	£0.36
26 way	£0.34	£0.39
34 way	£0.44	£0.51
40 way	£0.52	£0.60
50 way	£0.65	£0.75
60 way	£0.78	£0.90
64 way	£0.83	£0.96

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Single Pole Single Throw

	Each	+VAT
2 way	£0.70	£0.81
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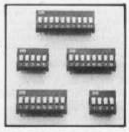

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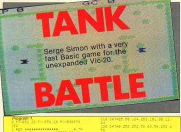
Interface



As REGULAR readers of *Your Computer* can see, machine code is used more and more for writing games. Such programs are much faster and more sophisticated than Basic programs, but are they better? Typing in those programs, mostly consisting of endless data lines is not a pleasant task, and for beginning computer enthusiasts it may be very discouraging. Also it seems as if people have forgotten that in Basic too, one can write good and reasonable fast games.

Therefore I have written this 100 per cent Basic program. It is Tank Battle, a two-player game for the unexpanded Vic-20. The program starts with displaying a title page, where you will be asked to enter the names of the two players.

If you have done this, and you have hit Return, you can see a sort of map on the screen, and two tanks.

The two players can move around the tanks and they can fire in the direction they move. The aim is — naturally — to destroy the other's tank and to score points. The keys to be used are:

For player one (black tank)
forward, Ctrl; turn, Shift; and fire, CBM
For player two (blue tank)
forward, £5; turn, £7; and fire, £3

The game itself is divided into two parts because of the limited memory of the standard Vic-20. First type in the program with the data statements for the user defined graphics. Then save it and type in the second part. Save this immediately after the first one. If you later load in the first program, the main program will be loaded automatically.

One last note: player one, who sits at the left side, may accidentally hit the Run-Stop key and thus break into the program. To prevent this add line:

```
2 POKE 45, 240: POKE 46, 26: POKE 788,
194
```

Program 1.

```
0 POKE52,28:POKE56,28:POKE36879
,152
1 REM ****************        * TA
NK BATTLE *        * SERGE SIMON
*        ****************
5 PRINT"TANK BATTLE"
6 PRINT"-MADE BY  SERGE SIM
ON-"
10 PRINT"UDG'S...PLEASE WAI
T..."
20 C=0:FORI=7168TO7679
30 READA:IFA=-1THEN51
40 POKEI,A:C=C+A
50 NEXTI
51 IFC<>12528THENPRINT"ERROR IN
DATA"
55 FORT=7168+256TO7168+256+8:POK
ET,0:NEXT
60 POKE198,0:POKE198,1:POKE631,1
31:NEW
90 DATA0,0,0,0,0,0,0,0
99 REMTANKS***********
100 DATA16,16,214,254,254,254,19
8,198
110 DATA25,50,124,253,191,30,12,
24
120 DATA0,252,252,56,63,56,252,2
52
130 DATA24,12,30,191,253,124,50,
25
140 DATA198,198,254,254,254,214,
16,16
150 DATA24,48,120,253,191,62,76,
152
160 DATA63,63,28,252,28,63,63,0
170 DATA152,76,62,191,253,120,48
,24
171 REMEND OF TANKS***
180 DATA0,54,126,62,60,126,124,2
0
190 DATA0,109,255,255,255,255,76
,0
191 DATA60,126,255,255,255,255,1
26,60
192 DATA0,0,0,24,24,0,0,0
193 DATA129,90,36,90,90,36,90,12
9
194 DATA124,60,126,120,60,124,12
6,60
300 DATA-1
```

```
0 PRINT"":V=36878:POKEV+1,152
1 FORT=1TO8:READR(T):NEXT:DATA-2
2,-21,1,23,22,21,-1,-23
5 PRINTCHR$(8)CHR$(142)
10 REM   TANKGEVECHT*   *DOOR SE
RGE SIMON *   *VLAANDEREN,BELGIE
*
40 PRINT"TANK  BATTLE
"
41 PRINT"BY SERGE SIMON"
45 PRINT"PLAYER 1:CBM/SHFT/C
TRLPLAYER 2:FUNCTION KEYS"
46 PRINT"GIVE NAME OF"
50 INPUT"PLAYER 1";B$:IFLEN(B$)
>6THENB$=LEFT$(B$,6)
60 INPUT"PLAYER 2";A$:IFLEN(A$)
>6THENA$=LEFT$(A$,6)
65 PRINT""
69 REM SETUP SCREEN***
70 POKE36869,255
71 FORT=44TO484:POKE38400+T,0:NE
XT
75 PRINT"KJJKJJJJKJJJJJJJJKJ
JK";
76 FORT=1TO20:PRINT"N"SPC(20)"N"
;:NEXT
77 PRINT"KJJJJKJJJKJKJJJJJKJJK";
:PRINTCHR$(157)CHR$(148)"J";
80 FORT=0TO20:P=RND(1)*484+22:PO
KE38400+P,5:POKE7680+P,11:NEXT
85 PRINT""SPC(4)"JK
JK"
86 PRINT""SPC(15)"KJ
KJ"
87 PRINT""B$;0,""A$;0
89 REM END SCREEN*****
90 PB=7680+3+242:PA=7680+17+242:
POKEPB,3:POKEPA,7:RA=7:RB=3:POKE
PB+30720,0
91 POKEPA+30720,6
95 KL=152:POKEV,10:TI$="000000"
96 MS=30:REM NUMBER OF BULLETS F
OR EACH PLAYER
99 REM TANK 1*********
100 A=PEEK(197)
101 IFA=63THENGOTO110
102 IFA=55THEN120
103 IFA=47ANDAS<MSTHEN130
104 POKEV-3,0:GOTO199
110 RA=RA+1:IFRA=9THENRA=1
111 POKEPA,RA:POKE30720+PA,6:GOT
O199
120 POKEV-3,255:POKEPA,32:PA=PA+
R(RA):IFPEEK(PA)<>32THENPA=PA-R(
RA)
122 POKEPA,RA:POKEPA+30720,6:GOT
O199
130 AS=AS+1:C=2:S=220:PK=PA:R=RA
:O=RB:GOSUB500:GOTO200
189 REM TANK 2*********
199 FORT=0TO25:NEXT
200 B=PEEK(653)
201 IFB=1THEN210
202 IFB=4THEN220
203 IFB=2ANDBS<MSTHEN230
204 POKEV-4,0:GOTO299
210 RB=RB+1:IFRB=9THENRB=1
211 POKEPB,RB:POKE30720+PB,0:GOT
O299
220 POKEV-4,255:POKEPB,32:PB=PB+
R(RB):IFPEEK(PB)<>32THENPB=PB-R(
RB)
222 POKEPB,RB:POKE30720+PB,0:GOT
O299
230 BS=BS+1:C=6:S=200:PK=PB:R=RB
:O=RA:GOSUB500:GOTO300
299 FORT=0TO25:NEXT
300 IFTI$<"000140"THEN100
310 KL=-(KL=152)*168-(KL=168)*15
2:POKE36879,KL
315 IFTI$<"000150"THEN100
316 PRINT"":POKE36869,240:POKEV
+1,152
319 POKEV-1,0:POKEV-4,0:POKEV-3,
0
320 PRINT"          SCORE
"
321 PRINT"(1)"B$;BB
322 PRINT"(2)"A$;AA
323 PRINT"PRESS KEY £"
330 GETA$:IFA$<>"£"THEN330
340 RUN
399 REM FIRE *********
500 POKEV-1,200:POKEV-4,180
510 FORT=1TO15
520 P=PK+T*R(R):IFPEEK(P)<>32THE
N550
530 POKEP,12:POKEV-1,S-T*4-10:PO
KEV-4,S-T*4:POKEP,32
540 NEXT
545 POKEV-1,0:POKEV-4,0:POKEV,10
:RETURN
550 IFPEEK(P)>8THEN545
560 POKEP,13:POKEV-1,140:POKEV-4
,0:FORT=15TO0STEP-.2:POKEV,T:POK
E30720+P,2-(RND(1)>.5)*2
563 NEXT
570 IFPA=PTHENBB=BB+1:RA=RA+3:RA
=RA+(RA>8)*8:POKEP,RA
580 IFPB=PTHENAA=AA+1:RB=RB+3:RB
=RB+(RB>8)*8:POKEP,RB
590 PRINT""B$;B2,""A$;AA:PO
KE30720+P,C:GOTO545
```

Loader.

```
1 POKE 23693,7: BORDER 0: CLE
AR 23999: LOAD A"CODE : LOAD ""C
ODE : PRINT "HIT ANY KEY..";USR
30069
```

The hex loader.

```
10 DEF FN h(h$)=16*(CODE h$(1)
-48-(7 AND h$(1)>"9"))+CODE h$(2
)-48-(7 AND h$(2)>"9")
20 INPUT "Start ";s
30 INPUT "Finish ";f
40 FOR n=s TO f STEP 8: PRINT n;": ";
50 LET tot=0: PRINT h$;
60 INPUT h$: PRINT h$;
70 LET x=0
80 FOR b=1 TO LEN h$ STEP 2
90 LET z=FN h(h$): LET tot=tot
+z
100 POKE n+x,z: LET x=x+1
110 LET h$=h$(3 TO ): INPUT t: PRIN
T " = ";
120 NEXT b
130 PRINT
140 IF tot<>t THEN PRINT "input
error - try again": GO TO 50
150 NEXT n
160 REM enter STOP to stop
```

Listing 1.

```
23296: 2A150124040125009 = 151
23304: 0325111C1D0C1E00 = 156
23312: 0905060C061F0D1E = 113
23320: 19140E191411260C = 171
23328: 182604152711260C = 209
23336: 1821005080F1E1506 = 133
23344: 2F11E2C080F2B08 = 219
23352: 1828151E23041E23 = 126
23360: 141E290001C0C0AFB = 146
23368: 210911150F180E0D = 105
23376: 0900E00F170B100D = 95
23384: 0C0D07050A140D0F = 0
23392: 0000000000000000 = 0
23400: 0000000000000000 = 0
23408: 0000000000000000 = 0
23416: 000000E95B2B7B5B = 580
23424: 000000E95B2B7B5B = 768
23432: 2377227788EC0BAFB = 875
23440: 5B7E5E7C5B2B27B5B = 155
23448: 261E221904040311 = 607
23456: 0484070400000E4E5 = 341
23464: 0324111C140C04130B = 839
23472: 03EC5FFE0707ED4F = 470
23480: 61FC90107000000 = 0
23488: 0000000000000000 = 0
```

SNAKES ALIVE is a 100 per cent machine-code game for any Spectrum which just fills all the memory available to the 16K machine. It features:

- 48 locations, which you are free to move between and around, and each of which is named.
- Choice of control by Kempston-type joystick, cursor type, Interface II or redefinable keyboard.
- Title screen with music, scrolling instructions and display of
- High-score table.
- Annoying addictiveness that makes you unable to stop playing!

The object of the game is to guide Kahn the snake around a house and its grounds to find and collect nine eggs which he has lost. It is totally non-violent — your poor snake is absolutely defenceless — which doesn't matter as there is nothing else about. The worst thing that can happen to Kahn is either bumping into an object, which results, in a nasty headache, or tying himself in knots. Despite Kahn being the only character that moves, the game is still frustratingly difficult.

On a blank cassette, save the loader program. This will load in the final code:

SAVE "SNAKES II"LINE 1

Type in the hex loader carefully. Save this on the other cassette, in case you don't type in all the hex in one go, or need to check it later.

Now Run the hexloader, type in the code from listing 1, and save the resultant code on the cassette with the loader, using:

SAVE "PRBF" CODE 23296,256

Run the hex loader again, and this time enter data from listing 2. Once finished, type:

SAVE "CODE II"CODE 28384,4384

This code should not be saved on the final cassette.

Repeat this exactly, except type in code from listing 3. It may be saved temporarily with the same save instruction as before. When you have typed in this code, type:

CLEAR 23833: NEW and then

CLEAR 23999: LOAD""CODE 2400

Load in the code from listing 2. Save the whole code on the finished cassette of the game, after the PRBF file, with:

SAVE "TOTAL"CODE 24000,8768

Summon up enough courage to try out the game — type Load"" and cross your fingers. If the game does not work perfectly first time, the most likely mistake that could have been made is that of entering one or more lines of hex data twice, or missing out others. The checksum is likely to stop other possible errors, but may not have the only solution, short of starting again from scratch, is to list the program from the hexloader, by loading in relevant sections of code. As a guideline — if the program when tested crashes straight away, the error is likely to be within the code typed in from listing 2.

SNA

Listing 2.

```
28384: 2B0C0E7EF0E0E0E0 = 1.1
28392: 8E4141C0C0E4A7A4 = 693
28400: 1DF9141C0C0E6A7C4 = 993
28408: 1DF9141C0C0E6A7C4 = 993
28416: 1C0C0E6A7C4C0E6A6 = 798
28424: 1C0C0E6A7C4C0E6A6 = 798
28432: 1C0C0E6A7C4C0E6A6 = 798
28440: 1C0C0E6A7C4C0E6A6 = 798
28448: 1C0C0E6A7C4C0E6A6 = 798
28456: 1C0C0E6A7C4C0E6A6 = 798
28464: 1C0C0E6A7C4C0E6A6 = 798
28472: 1C0C0E6A7C4C0E6A6 = 798
28480: 1C0C0E6A7C4C0E6A6 = 798
28488: 1C0C0E6A7C4C0E6A6 = 798
28496: 1C0C0E6A7C4C0E6A6 = 798
28504: 1C0C0E6A7C4C0E6A6 = 798
28512: 1C0C0E6A7C4C0E6A6 = 798
28520: 1C0C0E6A7C4C0E6A6 = 798
28528: 1C0C0E6A7C4C0E6A6 = 798
28536: 1C0C0E6A7C4C0E6A6 = 798
28544: 1C0C0E6A7C4C0E6A6 = 798
28552: 1C0C0E6A7C4C0E6A6 = 798
28560: 1C0C0E6A7C4C0E6A6 = 798
28568: 1C0C0E6A7C4C0E6A6 = 798
28576: 1C0C0E6A7C4C0E6A6 = 798
28584: 1C0C0E6A7C4C0E6A6 = 798
28592: 1C0C0E6A7C4C0E6A6 = 798
28600: 1C0C0E6A7C4C0E6A6 = 798
28608: 1C0C0E6A7C4C0E6A6 = 798
28616: 1C0C0E6A7C4C0E6A6 = 798
28624: 1C0C0E6A7C4C0E6A6 = 798
28632: 1C0C0E6A7C4C0E6A6 = 798
28640: 1C0C0E6A7C4C0E6A6 = 798
28648: 1C0C0E6A7C4C0E6A6 = 798
28656: 1C0C0E6A7C4C0E6A6 = 798
28664: 1C0C0E6A7C4C0E6A6 = 798
28672: 1C0C0E6A7C4C0E6A6 = 798
28680: 1C0C0E6A7C4C0E6A6 = 798
28688: 1C0C0E6A7C4C0E6A6 = 798
28696: 1C0C0E6A7C4C0E6A6 = 798
28704: 1C0C0E6A7C4C0E6A6 = 798
28712: 1C0C0E6A7C4C0E6A6 = 798
28720: 1C0C0E6A7C4C0E6A6 = 798
28728: 1C0C0E6A7C4C0E6A6 = 798
28736: 1C0C0E6A7C4C0E6A6 = 798
28744: 1C0C0E6A7C4C0E6A6 = 798
28752: 1C0C0E6A7C4C0E6A6 = 798
28760: 1C0C0E6A7C4C0E6A6 = 798
28768: 1C0C0E6A7C4C0E6A6 = 798
28776: 1C0C0E6A7C4C0E6A6 = 798
28784: 1C0C0E6A7C4C0E6A6 = 798
28792: 1C0C0E6A7C4C0E6A6 = 798
28800: 1C0C0E6A7C4C0E6A6 = 798
28808: 1C0C0E6A7C4C0E6A6 = 798
28816: 1C0C0E6A7C4C0E6A6 = 798
28824: 1C0C0E6A7C4C0E6A6 = 798
28832: 1C0C0E6A7C4C0E6A6 = 798
28840: 1C0C0E6A7C4C0E6A6 = 798
28848: 1C0C0E6A7C4C0E6A6 = 798
28856: 1C0C0E6A7C4C0E6A6 = 798
28864: 1C0C0E6A7C4C0E6A6 = 798
28872: 1C0C0E6A7C4C0E6A6 = 798
28880: 1C0C0E6A7C4C0E6A6 = 798
28888: 1C0C0E6A7C4C0E6A6 = 798
28896: 1C0C0E6A7C4C0E6A6 = 798
28904: 1C0C0E6A7C4C0E6A6 = 798
28912: 1C0C0E6A7C4C0E6A6 = 798
28920: 1C0C0E6A7C4C0E6A6 = 798
28928: 1C0C0E6A7C4C0E6A6 = 798
28936: 1C0C0E6A7C4C0E6A6 = 798
28944: 1C0C0E6A7C4C0E6A6 = 798
28952: 1C0C0E6A7C4C0E6A6 = 798
28960: 1C0C0E6A7C4C0E6A6 = 798
28968: 1C0C0E6A7C4C0E6A6 = 798
28976: 1C0C0E6A7C4C0E6A6 = 798
28984: 1C0C0E6A7C4C0E6A6 = 798
28992: 1C0C0E6A7C4C0E6A6 = 798
29000: 1C0C0E6A7C4C0E6A6 = 798
29008: 1C0C0E6A7C4C0E6A6 = 798
29016: 1C0C0E6A7C4C0E6A6 = 798
29024: 1C0C0E6A7C4C0E6A6 = 798
29032: 1C0C0E6A7C4C0E6A6 = 798
29040: 1C0C0E6A7C4C0E6A6 = 798
29048: 1C0C0E6A7C4C0E6A6 = 798
29056: 1C0C0E6A7C4C0E6A6 = 798
29064: 1C0C0E6A7C4C0E6A6 = 798
29072: 1C0C0E6A7C4C0E6A6 = 798
29080: 1C0C0E6A7C4C0E6A6 = 798
29088: 1C0C0E6A7C4C0E6A6 = 798
29096: 1C0C0E6A7C4C0E6A6 = 798
29104: 1C0C0E6A7C4C0E6A6 = 798
29112: 1C0C0E6A7C4C0E6A6 = 798
29120: 1C0C0E6A7C4C0E6A6 = 798
29128: 1C0C0E6A7C4C0E6A6 = 798
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33544: 0000C3C05C21E779 = 595
```
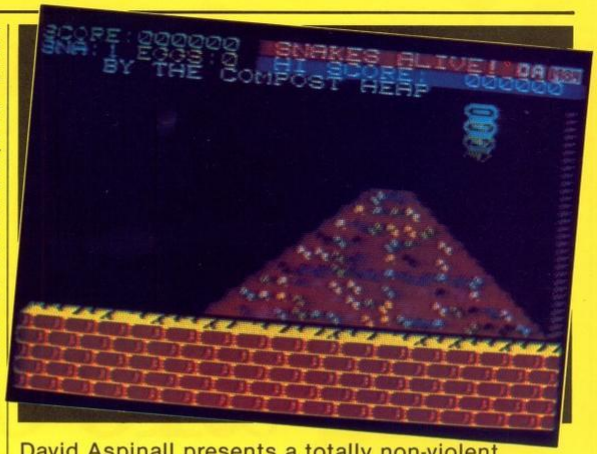

If it is during the game that an error becomes apparent, then look at the hex from listing 3. If, however, it is some mistake with the sound effects, or egg positioning, then check the code from listing 1.

Once the game has loaded, and works successfully, after pressing a key you will be shown the title screen to the game and some quite lengthy, but good, music will play. If this ends or is interrupted by a key press, the scrolling instructions will move slowly along the bottom line. Pressing S or O now will start or take you to the control options screen, respectively. On the control option screen, scrolling instructions again tell you which keys to press: 1 is keyboard, 2 — cursor joystick, 3 — Interface II joystick and 4 — Kempston-type joystick. The current choice is highlighted in white — the others in cyan.

I can supply tapes of the game, with both a turbo load — yes, in 16K! — and a normal load version of the game on, for only £2.75 inc. from: Snakes Alive, 16 Viking Way, Pilgrims Hatch, Brentwood, Essex, CM15 9HX. If you would also like a copy of my other game, Aliquid Simplex, published in *Your Computer* in November of last year, which includes sprites, two-channel music, etc., then I will put this on the same tape for you for another £1. Europe please add £1, overseas an extra £2.



David Aspinall presents a totally non-violent but, nevertheless exciting, game for the Spectrum featuring Kahn the snake.

AKES ALIVE

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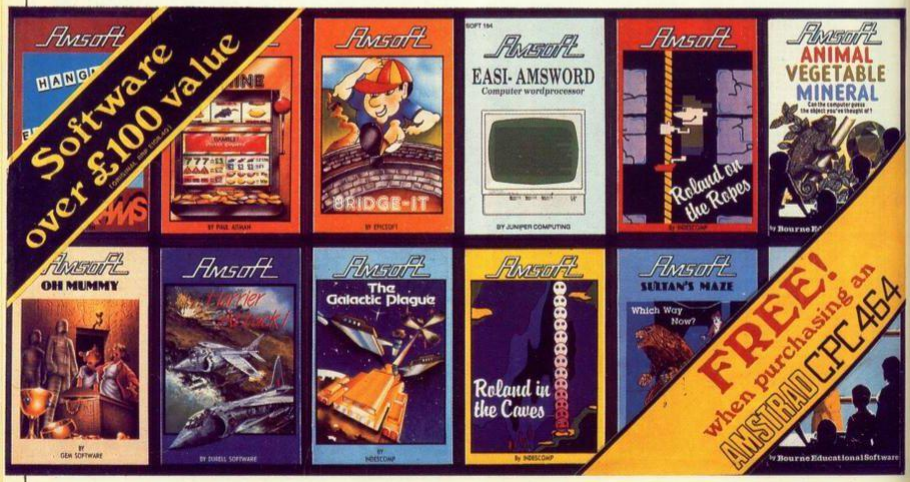
(continued on page 76)

Now Amstrad gives you over £100 to play with.



£239
complete with green screen VDU (GT64)

£349
complete with colour monitor (CTM640)

CPC464 complete with monitor and datacorder

Free software worth over £100 is the name of the game.

Along with your new CPC 464 (colour monitor or green screen VDU) you'll receive a software starter pack of 12 (yes, twelve) cassettes absolutely free.

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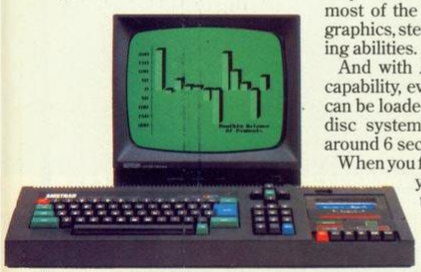
That's *one* good reason for making Amstrad's CPC 464 your new home computer.



CPC 464 green screen VDU (GT64)

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The CPC 464 comes complete with its own colour monitor or green screen VDU and built-in cassette data recorder. (Optional disc drives are now available with CP/M* and DR. LOGO* supplied as standard.)

It has a typewriter-style keyboard and numeric keypad. 64K of RAM, 32K of ROM and a very fast extended BASIC with real time features.

And it costs a great deal less than the price of a comparable system.

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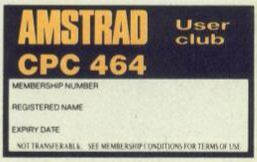

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(continued from page 73)

```
32443: 7C82827C82827C00 = 892
32444: 7C82827C82828200 = 816
32450: 00E0000E0001F800 = 1024
32472: F8FDCDCDCDFDF800 = 1616
32480: F0F8F8F8F8F8F800 = 1440
32488: FFB3AAAAB3BABBFF = 1581
32496: FFDDCDDDD3DEFFFF = 1616
32504: FC8E8E0E1E8E0000 = 816
32512: FF5B5B5B5B5BFFFF = 1360
32520: FC8282FE82828200 = 1040
32528: FC8282FE82828200 = 1040
32536: 7C8680808867C00 = 992
32544: 7C8680808867C00 = 992
32552: FE4442424444F800 = 830
32560: FE4442424444F800 = 830
32568: FE4040784040E800 = 854
32576: 3C4E8080E4E4E300 = 1170
32584: C6E8E8FE8E8E8C00 = 1170
32592: 0E0404E4C4E47900 = 945
32600: E4E4E4E4E4E4FE00 = 974
32608: 8080808080808FE00 = 848
32616: 8080808080808FE00 = 848
32624: 8EC8A9A9A9A9C8C00 = 1102
32632: 8EC8A9A9A9A9C8C00 = 1102
32640: FE4442828244380 = 658
32648: FE4442828244380 = 658
32656: FE4442828244380 = 658
32664: FC8E8E07C0E27C00 = 848
32672: FE92101010101000 = 590
32680: C6E8E8E8E8E87C00 = 990
32688: C6E8E8E8E8E87C00 = 990
32696: C6E8E8E8E8E87C00 = 990
32704: 0E44281028440C000 = 712
32712: 0E44281028440C000 = 712
32720: FE4408102042FE00 = 762
32728: FE4408102042FE00 = 762
32736: 00F000F000F000F000 = 480
32744: 00F000F000F000F000 = 480
32752: FF00FE00FC00E000 = 985
32760: 3C0C8B1B1D8663C = 1116
```

Listing 3.

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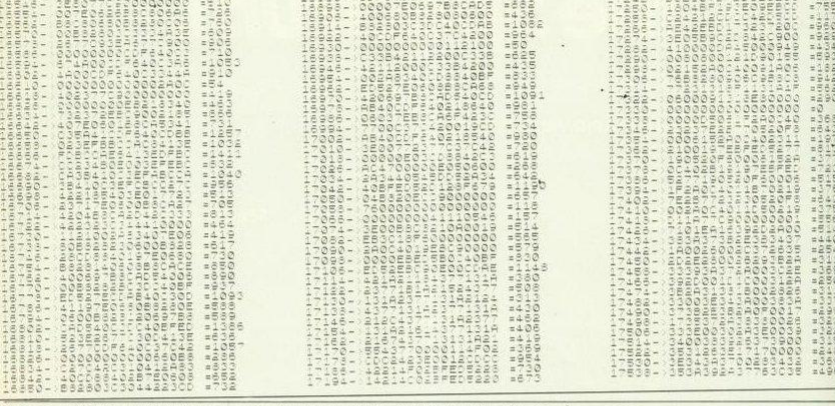


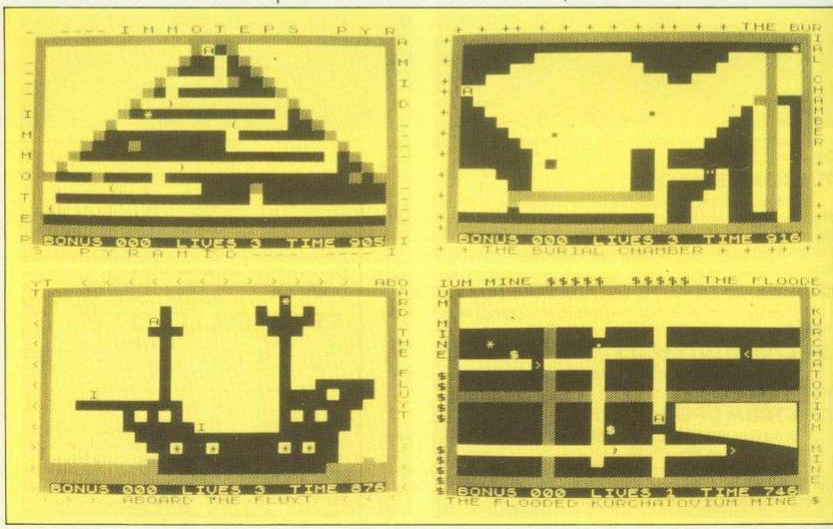
SURV

Adrian Spriddell survives.

THIS IS A ZX-81 graphic adventure game called Survivor containing 10 levels each with its own different screen display and running in under 5K of machine code including all data. And before you reach for a calculator, I know that it takes 7K to store 10 screens. The discrepancy is due to the effects of Bistromatics, the original program having been written on the back of an old restaurant menu.

You are a lonely little blue person with short spindly arms having next to no strength so you cannot hang from anything. You are, however, possessed of a pretty good pair of legs — good that is for running and jumping. Unfortunately, the standard ZX-81 graphics set is somewhat limited and most little blue people end up looking suspiciously like a capital A, and on most televisions, worse still a black and white capital A.

You have absolutely no defences or protection. Almost anything in your environment is hostile. In fact, about the only thing that will



(listing continued on next page).

VOR

not harm you is stepping on the cracks in the pavement.

Apart from flying bricks, arrows, boulders and anti-matter bombs being hurled at you, mummies, ghosts and horrid guards with sharp spears — OK then, dollar signs — are running around and will kill you if they get half a chance.

Not even the ground is safe entirely. Black blocks are OK and may be walked on or through with impunity but anything else black should not be trusted. There are grey seams of old Windscale waste around. These are impenetrable and although not immediately fatal, should you step on one, you will lose 50 health credits and have to start again. Bridges and elevators are there to help you — usually. Keys are: P — left; O — right; Shift — jump.

The object of your endeavours is to reach the inverse star which is the key to the exit. Once this has been achieved you will be awarded 100 points and the exit itself will appear as another inverse star. This is your way through to the next level. Any time points then remaining will be added to your bonus. If you fail to collect a key or reach an exit before the time count reaches zero you will lose a life but will be able to carry on — assuming that was not your last life — where you left off by pressing any key.

Keys Y, H or B will suspend the game while you grab asprin and a coffee. Pressing any other key will restart play.

Type in any 160 characters as line 1. Edit line 1 and change it to line 2. Edit this and change to line 3, etc. until you have lines 1 to 35. Type

POKE 22317,180

and line 35 should end in an inverse letter O. If it does not, a mistake has been made. Now enter as direct commands:

POKE 16510,0
POKE 16511,179
POKE 16512,22

This joins lines 1 to 35 together.

Enter a new line 1:

1 REM *** DO NOT DELETE ***

Make sure that you do not delete it.

Type in the Basic loader/checker from listing 1. Run, enter 16514 as the start address and enter the code from the hex dump one row at a time. Do not attempt to enter the equals sign or the following number. This is a checksum which should tally with what the computer is holding. It will be displayed on pressing N/L after entering every eight bytes. If the two totals are not the same, you have made an error in that line. Enter S to reRun the loader entering the start address of that line in answer to the prompt.

To test the game enter the lines of Basic from listing 2 and Run. If it crashes, reLoad from tape and Run 400 to check the code. When all is well, delete lines 20 onwards and add line 2:

2 SAVE "YC SURVIVOR"

The game contains a number of variables initialy set to nominal values but which may be Poked to effect changes as shown in table 1.

Listing 1.

```
  20 CLS
  30 PRINT AT 21,0; INPUT START
2000:43
  40 INPUT A
  50 CLS
  60 PRINT A;"-"
  70 INPUT A$
  80 IF A$="" THEN RUN 30
  90 IF A$="SAVE" THEN GOTO 260
 100 IF LEN A$ = 16 THEN GOTO 220
 110 PRINT A$;
 120 LET T=0
 130 FOR F=1 TO LE STEP 2
 140 LET B$=A$(F TO F+1)
 150 LET B=CODE B$+CODE B$(2)
 160
 170 POKE A,B
 180 LET T=T+B
 190 NEXT F
 200 PRINT T
 210 GOTO 60
 220 PRINT
 230 PRINT "INCORRECT LENGTH BLO
CK E.G.CENTER"
 240 PAUSE 4E4
 250 GOTO 60
 260 PRINT AT 21,0; PRESS
ANY KEY TO SAVE
 270 PAUSE 4E4
 280 SAVE "YC SURVIVOR"
 290 RUN 20
 400 CLS
 410 PRINT AT 21,0; INPUT START
2000:43
 420 INPUT A
 430 CLS
 440 LPRINT A;"-"
 450 LET T=0
 460 FOR F=1 TO 8
 470 LET B=PEEK (A+F-1)
 480 LET B=B+PEEK (A+F)*256
 500 LPRINT CHR$ (B+28);CHR$ (C+
28)
 510 LET A=A+2
 520 LET T=T+B
 530 NEXT F
 540 LPRINT " ";T
 550 GOTO 420
```

Listing 2.

```
  20 CLS
   4 POKE 17287,0
   6 RAND USR 17795
   8 PRINT AT 10,8;"
   9 PRINT AT 11,8;" ANOTHER GAM
E?"
  8 PRINT AT 12,8;"
  9 INPUT A$
  10 IF A$="Y" THEN GOTO 3
  11 STOP
```

Table 1.

Address	Nominal value	Parameters	Function/notes
16674	204	see note	Wait key. Change to 202 for Break key
18863	61	see note	Change to 0 for infinite lives
17021	3	2 to 5	Speed. Increase to slow play
17287	0	0 to 9	Level.
19050	50	0 to 250	Grey block penalty points

(listing continued from previous page).

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```
10 MEMORY HIMEM-10
20 start=HIMEM+1
30 |ASSEMBLE,start
40 'get start
50 'limit &FFFF
60 'ORG start
70 'CP 10:SCF:RET Z
80 'RST 1,&B7F2
90 'ORG &BD2B
100'JP start
110'END
```

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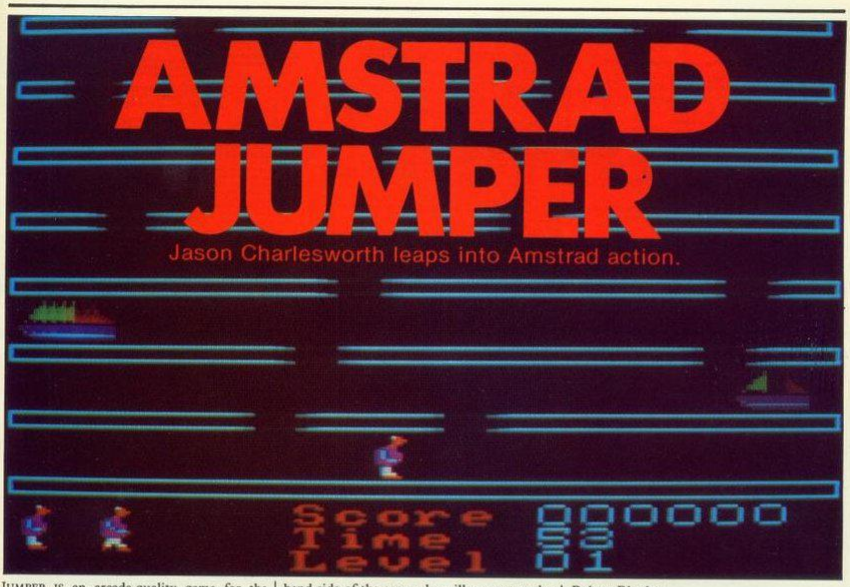

JUMPER IS an arcade-quality game for the Amstrad CPC-464 computer in which you must guide a little man called Jumper to the top of the screen.

To get to the top of the screen, Jumper must jump through the moving holes in the platforms but if he falls through a hole he will be stunned and so will be unable to move for a while. However, all the time the nasties are advancing and Jumper, being a nice sort of chap, does not want to kill them so he must run away from them. To help him do this, the screen is wrap round i.e. if he runs off the left-hand side of the screen he will appear on the right-hand side and vice versa.

The scoring in the game is based on how many times you jump up. The more times you jump up, the more points you get and the amount of points you get per jump increases every other round. If your score is high enough at the end of the game, the program will ask for your name.

The game has 15 screens featuring different combinations of the nasties — yachts, teapots, telephones and tanks — and on each screen continuous music plays — translated by Robert Rhodes.

The game also features a joystick option and a hard or easy game option. To set up the game type in listing 1 and save it with

SAVE "JUMPER"

Next type in listing 2 and run it. If it finds an error in the code, correct it then rerun the program and when it gives the "Finished, no errors" message, save the code with

SAVE "CODE",b,35900,3700

The game may now be played by rewinding the cassette and typing Run'".

Listing 2 is on the next page.

Listing 1.

```
100 e=0:j=1:DEF FN x(n)=10*INT(PEEK(n)/16)+PEEK(n)-16*
INT(PEEK(n)/16)
110 INK 1,24:INK 14,26,0:INK 15,0,26:INK 5,0:INK 8,15:
INK 9,3:INK 13,4:INK 10,3
120 GOSUB 130:GOTO 360
130 REM SETUP
140 MEMORY 32767:BORDER 0:INK 0,0:MODE 0:PRINT"Please
wait":LOAD "!":e=0:j=1
150 ENV 1,5,2,1,5,1,1,1,0,8,5,-1,1,5,-2,3
160 DIM a$(5),a(5):FOR a=1 TO 5:READ a$(a),a(a):NEXT a
170 DATA Super Ted,50,Shaggy the Yak,40,Black Adder,30
,Doomdark,20,Mangled Cassette,10
180 RETURN
190 REM demo
200 BORDER 1:INK 0,1:MODE 0:CALL 35900
210 FOR a=0 TO 999:z$=INKEY$:NEXT a:BORDER 0:INK 1,0:R
ETURN
220 REM game
230 BORDER 1:INK 0,1:CALL 35946
240 FOR a=0 TO 1999:z$=INKEY$:NEXT a:BORDER 0:INK 0,0
250 sc=10000*FN x(37856)+100*FN x(37855)+FN x(37854)
260 FOR a=1 TO 5:IF sc<a(a) THEN NEXT a:GOTO 290
270 IF a<>5 THEN FOR b=5 TO a+1 STEP -1:a$(b)=a$(b-1):
a(b)=a(b-1):NEXT b
280 CLS:PEN 1:INK 1,24:INPUT "Name ",a$(a):a(a)=sc
290 RETURN
300 REM High score table
310 BORDER 0:INK 0,0:MODE 0
320 PEN 2:PRINT"  High Score Table":FOR a=1 TO 5:PEN a
+5
330 LOCATE 1,2*a+3:PRINT a$(a):LOCATE 16,2*a+3:PRINT a
(a):NEXT a
340 LOCATE 3,24:PEN 2:PRINT"Press a key"
350 IF INKEY$="" THEN 350 ELSE RETURN
360 REM instructions
370 BORDER 0:INK 0,0:MODE 0:PRINT"   Instructions"
380 RESTORE 360:FOR a=5 TO 11:READ z$:LOCATE 1,2*a-3:P
EN a+1:PRINT z$:NEXT a
390 LOCATE 1,24:PEN 1:PRINT"   Press a key"
400 IF INKEY$="" THEN 400
410 DATA Z     Left,\     Right,SHIFT Jump,0     Abort
,H     Halt,S     Start,SPACE Music on/off
420 DATA 1     Game,2     Demo,3     Easy game,4     Hard
game,5     Joystick,6     Keys
430 MODE 0:PRINT"     OPTIONS"
440 FOR a=2 TO 7:READ z$:LOCATE 4,2*a+2:PEN a+4:PRINT
z$:NEXT a
450 IF j=1 THEN LOCATE 4,14:PEN 14:PRINT"5":PEN 1:PRIN
T:PRINT"   6" ELSE LOCATE 4,14:PRINT"5":PRINT:PEN 14:P
RINT"   6":PEN 1
460 IF e=1 THEN LOCATE 4,10:PEN 14:PRINT"3":PEN 1:PRIN
T:PRINT"   4" ELSE LOCATE 4,10:PRINT"3":PRINT:PEN 14:P
RINT"   4":PEN 1
470 z$=INKEY$:IF z$="5" THEN j=1 ELSE IF z$="6" THEN j
=0
480 IF z$="3" THEN e=1 ELSE IF z$="4" THEN e=0
490 IF z$<>"1" AND z$<>"2" THEN 450
500 PEN 1:IF z$="2" THEN GOSUB 190:GOSUB 300:PEN 1:INK
1,24:GOTO 360
510 IF z$<>"1" THEN 490
520 POKE 37853,e:IF j=1 THEN POKE 37562,74:POKE 37570,
75:POKE 36659,72 ELSE POKE 37562,71:POKE 37570,22:POKE
36659,21
530 GOSUB 220:PEN 1:GOSUB 300:PEN 1
540 GOTO 360
```

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CBM-64

The Telsoft service now extends to include the CBM-64.

THIS MONTH we are pleased to be able to announce the extension of the Telsoft service to Commodore 64 owners. It will be available initially to users who have the OEL Comms pack coupled with the Telemod 2 or similar modem.

Both the downloading program — which is listed with this article — and the full user-to-user communications program for the C-64 have slightly different menus to those produced for the BBC and Spectrum computers — see page 88.

The main difference is the addition of a machine-code Save routine which was considered essential since this is absent from the Commodore operating system. The full C-64 menu is: (1) Receive; (2) Transmit; (3) Chat; (4) Set Baud Rate; (5) Return to Basic; (6) Save Bytes — ie machine code sections. Brief details of the functions of these menu options are as follows:

Chat mode: This mode allows a real time conversation between the users with automatic changeover from one end to the other. Each time characters are entered from a different end a carriage return is generated automatically which ensures that the text sent by the two ends is not mixed up on the same line.

Transmit and Receive modes: These modes are used to transfer data between computers and if both users start off in the Chat mode the procedure is semi automatic, as follows:

The user who is going to send the program presses his Stop key which reverts the computers at both ends to the menu. Menu option 2 is called to go to Transmit mode and the user will then be asked to enter details of the data that is to be transmitted to the distant end.

Both the transmitting and receiving ends get a visual display of the progress of the data or program transfer. The data is sent in 256 character blocks, each block being numbered in hex and finishing with an OK if the receiving end calculates that it has received the block without any errors.

If the block contains errors, the OK is

Figure 1.

```
5 REM   HEX LOADER FOR CBM 64   FIG.1
6 REM
10 FOR I=680 TO 727:READA:POKEI,A:T=T+A
20 NEXT:IF T=6716 THEN GOTO 100
30 PRINT"ERROR IN DATA ";T-6716:END
40 DATA 169,1,133,186,169,1,133,184
50 DATA 133,185,169,8,133,183,169,208
60 DATA 133,187,169,2,133,188,169,56
70 DATA 133,251,169,199,133,252,169,251
80 DATA 162,231,160,206,32,216,255,96
90 DATA 68,79,87,78,76,79,65,68
100 SA=51000:LA=52855
110 INPUT"START ADDRESS";A
120 IF (A<SA) OR (A>LA) THEN GOTO 140
130 IF A/8=INT(A/8) THEN GOTO 150
140 PRINT:PRINT"ADDRESS ERROR":GOTO 110
150 T=(A-32768)AND255:PRINTA;:INPUTD$
160 IF D$="END" THEN GOTO 900
170 IF LEN(D$)>20 THEN GOTO 190
180 PRINT"WRONG LENGTH":GOTO 150
190 FOR B=0 TO 7:B$=MID$(D$,2*B+1,2)
200 GOSUB 300:IF E=1 THEN GOTO 280
210 POKE A+B,D:T=T+D:NEXT
220 B$=MID$(D$,18,3):GOSUB 300
230 IF E=1 THEN GOTO 280
240 IF T=D THEN GOTO 260
250 PRINT"CHECKSUM ERROR":GOTO 150
260 A = A+8:IF A<LA THEN GOTO 150
270 GOTO 800
280 PRINT TAB(8+2*B+D)C$"??"
290 B=8:NEXT:GOTO 150
300 E=0:D=0:FOR N=1 TO LEN(B$)
310 C$=MID$(B$,N,1):GOSUB 400
320 IF E=1 THEN D=N:N=4:NEXT:RETURN
330 D=D*16+X:NEXT:RETURN
400 X=ASC(C$)-48:IF X<0 THEN E=1:RETURN
410 IF X<10 THEN RETURN
420 X=X-7:IF X<10 THEN E=1:RETURN
430 IF X>15 THEN E=1
440 RETURN
500 H$="0123456789ABCDEF"
510 FOR A=SA TO LA STEP 8
520 PRINT A;"? ";:T=(A-32768)AND255
530 FOR B=0 TO 7:X=PEEK(A+B):GOSUB 600
540 T=T+X:NEXT:PRINT";"
560 Y=INT(T/256):PRINT MID$(H$,Y+1,1);
570 X=255 AND T:GOSUB 600:PRINT
580 NEXT:GOTO 900
600 PRINT MID$(H$,INT(X/16)+1,1);
610 PRINT MID$(H$,1+(XAND15),1);:RETURN
800 SYS 680:C$=CHR$(34)
810 PRINT:PRINT" TO RELOAD CODE :"
815 PRINT:PRINT"  LOAD"C$"DOWNLOAD";
820 PRINTC$",1,1  (RETURN)"
825 PRINT:PRINT"  THEN TYPE   NEW";
830 PRINT"  (RETURN)"
835 PRINT:PRINT"TO RUN THE PROGRAM";
840 PRINT"  SYS 51000  (RETURN)"
900 PRINT:PRINT:PRINT"1  ENTER DATA"
910 PRINT:PRINT"2  PRINT DATA"
920 PRINT:PRINT"3  SAVE DATA"
930 INPUT Z:ON Z GOTO 100,500,800
```

Figure 2.

```
51000 ? A9068D21D08D20D0=3E2
51008 ? A98FED0682A90E20=2E4
51016 ? D2FFA9008D15D0A9=4DD
51024 ? FFBD8A02BA8E92CE=510
51032 ? 20CAC920C7C820F8=4D5
51040 ? CA8D00CEC931F023=532
51048 ? C935F014C936D006=43F
51056 ? 208EC74C58C7A914=410
51064 ? 20D2FF202FCBD0B9=52E
51072 ? 203FC8A92020D2FF=461
51080 ? 4C33C34C4C82063=411
51088 ? CC2022CDA95B85FD=4F1
51096 ? A9CE85FE2028CDA0=547
51104 ? 002035CC202FCBC9=404
51112 ? 44F008C954D0ED20=4E1
51120 ? D2FFA901D007A944=4EF
51128 ? 20D2FFA90885BA20=4B9
51136 ? 25CDA90820A8CCA9=4A3
51144 ? BD85FDA9CD85FEA9=6A0
51152 ? 002035CC2025CD20=383
51160 ? 95CC9848D0048C83=4CC
51168 ? CE20D8C968A82025=4C4
51176 ? 002035CC9848A90E=4C5
51184 ? 8D83CE20D8C9ADA7=5E3
51192 ? CE85FBADA8CE85FC=6ER
51200 ? 68A8206CBA90185=39A
51208 ? 20D5CDA9FD85FEA9=539
51216 ? 20BDFFAEA9CEACAA=567
51224 ? CEE8D001C8202SCD=479
51232 ? A9FB20D6FF20F1CB=597
51240 ? 6020B9CC98DD003=3FE
51248 ? A90085C7A9020D2=3E8
51256 ? FFA90D20D2FF60A9=4E7
51264 ? 8D2029C8A90D20D2=306
51272 ? FF602063CCA000A9=43F
51280 ? FC9993CECBD0FA20=5FB
51288 ? D2CB90FB20D2CBB0=5ED
51296 ? FB8D72CEA0008C7C=4D0
51304 ? CE8C7DCE202ECCAD=4D4
51312 ? 72CE29F0C900D0E4=5C6
51320 ? 20D2CB80DA9973CE=599
51328 ? C8202ECC009D0F0=4EB
51336 ? A000AD76CE2980D0=492
51344 ? 0FA52B85FB18A52C=3D8
51352 ? 6D75CE85FC4CAAC8=587
51360 ? AD78CE85FBAD79CE=687
51368 ? 85FC20D2CBB0A820=55E
51376 ? D9CC20D2FFC820D9=607
51384 ? CC202ECCC010D0EA=520
51392 ? A92020D2FFAD75CE=56A
51400 ? 202ECD20D2CBB007=4D7
51408 ? CD7CCEF00BA95820=503
51416 ? D2FF203C84C5708=52C
51424 ? 20D2CB80F8CD7DCE=65D
51432 ? D0EBAD75CEA8B993=687
51440 ? CED0E2030C8A991=4EE
51448 ? 20D2FE4C7EC94C57=51F
51456 ? C8A0008C7CCE8C7D=447
51464 ? CE20D2CBB0F091FB=53F
51472 ? 202ECCC8CC77CED0=4D3
51480 ? FB20D2CBB0E0D7C=59E
51488 ? CEF008A95820D2FF=4DB
51496 ? 4C57C820D2CBB0CE=4CE
51504 ? C7DCEF0034C23C9=473
51512 ? 20ACCB2030D7B9D75=489
51520 ? CEA8A900999CEAD=506
51528 ? 84CEC902D2520BC=436
51536 ? CBA9C820F3CBA955=568
51544 ? 2016CDA95020F3CB=432
51552 ? 20C7CBAC73CE088=54F
51560 ? B993CED02398D0F7=5D4
51568 ? 4C5BC7A9552016CD=3DF
51576 ? 20F1CB4C63C9AC77=4EF
51584 ? CE20D2CBB00FA20=57D
51592 ? D2CB20D2CB4C47C9=53E
51600 ? 4C5CC8A52B85FBA5=4F5
```

TELSOFT

omitted and the block is retransmitted by the sending end until it is received without error.

When data transfer is successfully completed Program loaded OK is printed at both ends and they then revert back to Chat mode.

Set baud rate: This gives the user the option to change baud rates to try out different methods of working; e.g., the Telemod 3 has the facilities for full duplex working at 1200/75 and 75/1200. However, the program was specifically written for 1200/1200 bit/s half duplex working — selection 4 from the baud rate menu.

Save bytes: As mentioned earlier this facility is built in to enable users to save any number of machine code sections to tape or disc after downloading. The start and finish memory addresses of the machine code can be entered using either decimal or hex numbering. Naturally, any Basic program located in its usual position in memory — i.e., 2048 upwards — should be saved using the machine's built-in Save to tape or disc facility.

Only the Download section of the machine code is given in this listing, not the Transmit and Chat routines.

When you have been returned to the menu, exit to Basic and list the first few lines of the program where we will give the instructions needed to Save the program to tape or disc.

The download program is approximately 1800 bytes in length and consists of a Basic hex loader program and a list of machine code. Type in the hex loader program listed in figure 1 and then Save to tape or disc before you Run it. When the hex loader program is run the computer will give the prompt "Start address (hex)?" and you should enter 51000 and press Return.

The computer will print the start address of the line and a question mark — e.g., 51000? — you then have to enter all the characters after the question mark from the relevant line in figure 2 and press Return at the end of the line. If all is well you will be prompted with the next address and so on. Each line comes with its own checksum so that you can correct any errors as you go.

If you want to enter the machine code in several sessions you can save part of the code — but to tape only — by entering End instead of the next line of data when you are prompted with a line number and question mark. When you want to continue typing in the machine code program it is reloaded with the command.

When you have entered all the machine-code lines the hex loader program will automatically save this machine-code section with the title Download, so make sure that you have your tape recorder or disc ready to record, before starting to type in the machine-code section.

If you want to enter the machine code in several sessions you can save part of the code (but to tape only) by entering End instead of the next line of data when you are prompted with a line number and question mark. When you want to continue typing in the machine code program it is reloaded with the command.

LOAD "DOWNLOAD",1,1

then enter New and Load and Run the hex loader program.

When you have completed and saved the Download program it is reloaded with the command

LOAD "DOWNLOAD",1,1

or 8,1 for disc — followed by the New command. To Run the program, enter

SYS 51000 (Return)

Modem transmit speeds

Provided the machine code is correct you will be asked to select the modem transmit and receive speeds. For the OEL Telemod 2 modem simply select Option 4.

To receive software from Telsoft, the *Your Computer* downloading service, first dial up Colchester (0206) 8068 and check when software for your machine is being downloaded. This audio recorded information service will also advise you which telephone numbers to ring for the 300 and 1200 bit/s downloading services.

When a program you want to download is available, make sure your modem is correctly set up and dial up the telephone number appropriate to your modem's speed. When you hear the modem tones switch the modem to line and replace the receiver.

Select Option 1 from the menu — Receive. As each block of data is received the block number and the program title will be displayed, followed by "OK" if there were no errors. Note that the "OK" will be missing from any blocks in which there were detected and that the downloading program will wait for these blocks to come round again in order to make a second attempt to load.

When all blocks have been loaded, the Program loaded OK message will appear and you will be returned to the menu or Chat mode after which select Option 5 to leave the Telsoft Menu and list the first few lines of the Basic program you have received to get the necessary Saving instructions. ■

```
51608 ? 2C85FCA000B1FB99=52A
51616 ? 2200C9B1FB8523F0=4CE
51624 ? 0BA5228F8A5238S=447
51632 ? FC4C9BC918A5FB69=57D
51640 ? 02852D852F8531A5=37B
51648 ? FC690852E853085=412
51656 ? 32602063CC8A0020D=3E1
51664 ? 84CE90B8D02DE60=4A3
51672 ? 8E81CE8C82CEA200=533
51680 ? A9098DCDCE202FCB=4D4
51688 ? C914F016C90DF051=4E2
51696 ? C924D01920D2FF8D=544
51704 ? C3CEE84CE5C9E000=64B
51712 ? D0E3E000F0DF20D2=554
51720 ? FFC84CE5C9C93090=554
51728 ? D4C93A901548D0C3=444
51736 ? CEC924F004684CE5=460
51744 ? C968C94190BFC947=4BA
51752 ? B0B20128FF38E930=4D5
51760 ? C98A9002E90E9D85=36A
51768 ? F0B9D0C3CEE84CE5=61A
51776 ? C9E000F0A0E001D0=52A
51784 ? 97BDC3CEC924F095=4FF
51792 ? A9202D2FA98F29=54F
51800 ? C3CEA2008ECFCEBE=544
51808 ? D0CEBED1CE9ED2CE=659
51816 ? ADC3CEC924D006A9=512
51824 ? 8D0CFCD0F31BCE5D=5D0
51832 ? C9FFF01D20CBCAB0=5B2
51840 ? 3418BDC3CE5DCFCE=524
51848 ? 8DCFCEA9006DD0CE=566
51856 ? 8DD0CEB020E84C75=534
51864 ? CA4DCFCEAC83CE59=642
51872 ? A3CEC8ADD0CE99A3=660
51880 ? CEC8198C83CEACB2=561
51888 ? CEAE81CE60202CD=4ED
51896 ? A200BD41CEC321F0=500
51904 ? 0720D2FFE84CBACA=570
51912 ? 4CDEC3ADCDCE8DCE=65E
51920 ? CEADCFCE8DD1CEAD=6C1
51928 ? D0CE8DD2CE18ADD1=633
51936 ? CE6DCFCE8DCFCEAD=68F
51944 ? D2CE5DD0CE8DD0CE=6BE
51952 ? 8005CECECED0E660=625
51960 ? 2063CC a99F8D602=414
51968 ? A9518FD89CD85FE=575
51976 ? A000209DCC20ZSC=343
51984 ? 209DCC209DCC209D=3DF
51992 ? CC2022CD20A9CC20=3A8
52000 ? 95CC2022CD2095CC=411
52008 ? 202FCB20FCB4008=421
52016 ? 81CE8C82CE2069CC=4B0
52024 ? 20CCCC20CACCC900=48F
52032 ? D00D20FDCCC931F0=4F0
52040 ? 062001CC4C35CB8D=314
52048 ? 80CEAE81CEAC82CE=597
52056 ? 60AE92CE9A4C5BC7=4CE
52064 ? 2022CDA92285FDA9=465
52072 ? CE85FA000285C=4D9
52080 ? 2025CDA00FA92099=393
52088 ? 93CE88D0FA8D93CE=619
52096 ? 202FCBC914D010C0=417
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52120 ? 0DF00B20D2FF9993=4BD
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52168 ? 538D00DE9528D00=40E
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52256 ? A9200D2FFA90320=3A6
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52328 ? 6048A85A2290F0D1F=37E
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52400 ? 202DD2FFCA0FAAE=603
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52488 ? AD01FE60A8AD00DE=307
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52512 ? CC60202SCD2020CD=373
52520 ? A900D2DFF604829=390
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52576 ? 20202052454345A9=228
52584 ? 5645213520202045=1FE
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52728 ? 414444524553320=31E
52736 ? 464F52204154 2=220
52744 ? 202146494E414C20=1D3
52752 ? 414444524553320=236
52760 ? 464F5220415245 2=238
52768 ? 202150524F2420=22C
52776 ? 4D205449544C4520=237
52784 ? 284D415820313620=1E5
52792 ? 434841522253292=219
52800 ? 211224E4F54205641=21B
52808 ? 4C49449222C205452=2A5
52816 ? 592041474144E20=249
52824 ? 3A202144495343220=216
52832 ? 4F52205441504520=26B
52840 ? 282044F54202320=1E0
52848 ? 3F2100000000000=8D0
```

ELSETT

A reminder of how to use the Telsoft service.

THE PROGRAMS given here with enable Spectrum and BBC users to download via *Your Computer's* Telsoft service. First type the hexloader for your machine — figure 1 — and then enter the machine code — figure 2. On the BBC you call the service by entering

CALL &6A00

while Spectrum owners must type

RANDOMIZE USR 60000

So far OE Ltd's Telemod 2 and VTX 5000 modems have been tested with the service, but it also works with a number of other makes.

To find out what is available on Telsoft and how to receive software dial up Colchester (0206) 8068. This audio recorded information line will also advise you which telephone numbers to ring for the 300 and 1200 bit/s services.

When a program you want to download is available, make sure your modem is set up and dial the number appropriate to your modem's speed. As soon as you hear the modem tones switch the modem to line and replace the receiver. Select Option 1 from the menu — Receive. After a block of data is received, you will see "OK" printed if there were no errors, otherwise the program will wait for the blocks to come round again.

When the "Program loaded OK" message appears return to the Telsoft menu and select Option 5. You can now save and run the program.

Figure 1. BBC.

```
10 REM BBC HEX CODE LOADER
15 HIMEM=&69FF
20 CLS:PRINT
30 INPUT " START ADDRESS (Hex):"A#
40 A=EVAL("&"+A#)
50 IF A>&6FF7 THEN 200
60 IF A<&2600 OR A>&AFE7 THEN 20
70 PRINT "A" ";
80 INPUT ";" D#,C#
90 IF LEN(D#) <>16 THEN 50
100 T=0
110 FOR N=0 TO 7
120 X=: H$=MID$(D#,2*N+1,1): GOSUB 300
130 IF E=1 THEN 260
140 X=: H$=MID$(D#,2*N+2,1): GOSUB 300
150 IF E=1 THEN 260
160 B= EVAL("&"+MID$(D#,2*N+1,2))
170 ?A=B:A=A+1:T=T+B
180 NEXT
190 FOR N = 1 TO LEN (C#)
200 X=MID$(C#,N,1):GOSUB 300
210 IF E =1 THEN A=A-1: GOTO 260
220 NEXT
230 IF T= EVAL("&"+C#) THEN 50
240 PRINT "CHECKSUM ERROR !"
250 A=A-8:GOTO 50
260 PRINT "TYPING ERROR !"
270 A=B*(A DIV 8):GOTO 50
280 SAVE "DOWNLOAD" &6B0 &FB7
290 END
300 E=0:IF ASC(X$)<48 THEN E=1:RETURN
310 IF ASC(X$)<58 THEN RETURN
320 IF ASC(X$)<65 THEN E=1:RETURN
330 IF ASC(X$)>71 THEN E=1
340 RETURN
```

Figure 2. BBC.

```
6A00 1&C0BF291762BD56D,477
6A10 1C8C4750BF12D0C,C4
6A20 1E3FF2D61&C2B0C9C,30A
6A30 13F80BC934F8E9C9,4D
6A40 135F8B4&C8C&4C47,20B
6A50 1A6A9B2C8E3FA9C0,4B2
6A60 1A8A0A2FF2BFAF9,4F0
6A70 1B3A2A0&FAFFA9A,3&3
6A80 1A2A220FAFFA9C0A8,4C8
6A90 1FEA2020FAFF6A&A9,4BC
6AA0 1BC2B&3FF2B&76A&A,439
6AB0 115A2B120FAFFA&B0,3E8
6AC0 1A9FF&B99&5&FD8F,587
6AD0 1A9F15A2B120FAFF20,394
6AE0 1&C&C9F&2B0&C&C&0,348
6AF0 1FBA0B0A4778478B4,416
6B00 17B47&B478B7&2B,3&8
6B10 1D5&D57829FBC9B0,4B9
6B20 1D8C2208&C&D8D49,4A8
6B30 1A0C&2D05&DC&B9,&A4
6B40 1D8FB&B0&A57429B0,422
6B50 1D8B9&51C85&1B&5,354
6B60 11D&5738577720&C,209
6B70 1B0&52&3FFCB2B0D5,524
6B80 1&DC&1B0&FB&57320,435
6B90 1&2&D20&C&C8B&C5,3CC
6BA0 17AF8B0A95028E3FF,478
6BB0 12BE7FF4C&7A2B0C,34F
6BC0 1&D80CC57FB0BA9,48C
6BD0 15B28E3FF2BE7FF4C,4&C
6BE0 1&7A&573A&B9F95&F,43E
6BF0 1D8B0E2B7FFA9B20,38D
6C00 13FF4C83&A&C&7A,4A9
6C10 1FAFF8B09C&D7D8B5,44B
6C20 1&B&4C8C&A47E20,2D4
6C30 1496CC&BFD8D23B&0,374
6C40 1C0A4750BF12D0C,A9&
6C50 1E0BE3C57AF0BA9580,4CE
6C60 12B3FF2B7FF4C&7,4B4
6C70 1A&D0C2D2C&BC5378,3C1
6C80 1FB0A&A9B0B47E&B,450
6C90 12B49&C8B0B0A47E,449
6CA0 1A8A9E8A0B0B2FF2B,452
6CB0 1FAFFA9B0B5BA9B7,4&8
6CC0 12B3FF2B0A&D&9B,3E4
6CD0 12B0B6EA9B9B0A9,2F8
6CE0 1&F0B5A&B0B2FB&D,39C
6CF0 1015&DC9319B0B7,378
6D00 142F11C945F8174C,3A2
6D10 1&1&A9B0A2B12F4,335
6D20 1FFBCF&C&B&2B3,3C4
6D30 12BF4FFA&7C&A9B8,433
6D40 1A2B4&2BFF&B0A5,4CE
6D50 17C2BE3FFA4F2B0A,4&B
6D60 1&A9B0B2B0E2B0F2,2C4
6D70 1&A&B17B15&C941,2D0
6D80 1F8B7C&21B1C943,413
6D90 1FB174C&1&CA9B7A2,372
6DA0 1B12BF4FF&B9&D9,37F
6DB0 1A7B2B32BFF4FC&B9,314
6DC0 1FB1F4C&1&CA9B7A2,372
6DD0 1B12BF4FF&B9&D9,37F
6DE0 1F8BC942F81C943,413
6DF0 1FB174C&1&CA9B7A2,372
6E00 1B12BF4FF&B9&D9,37F
6E10 1&B0BA9B62BF4FFE8,4F0
6E20 1B0F12A97FC92B0B,3C3
6E30 1BC9&AFB&A&7D6BC9F,55F
6E40 1B0B&A9B62BF4FFE8,4F0
6E50 1B0F12A97FC92B0B,3C3
6E60 1BC9&AFB&A&7D6BC9F,55F
6E70 1B3B2B42&17B5&4B,2B9
6E80 1B4&7B7&B2A9F9,44B
6E90 1A2B120FAFF4A9B3A2,484
6EA0 1B720FAFFA99&A2B0,483
6EB0 1A91B85A2A7&A7B,29F
6EC0 1A91B85A2A7&A7B,29F
6ED0 1&CAD8E&B2B3FFCB,5AC
6EE0 1B12C9B0DB4FC&B4,4F7
6EF0 1&CAD&A9B2B3FFCB,5AC
6F00 1CA0BFA&7D6BC9F,55F
6F10 1B3B2B42&17B5&4B,2B9
6F20 1&1B2B2B37352B42,1AF
6F30 1B3B2B42&17B5&4B,2B9
6F40 1&1B2B2B37352B42,1AF
6F50 1&2&17B54285214,2C3
6F60 1&2&17B54285214,2C3
6F70 1&5B0B5B2AF475241,23D
6F80 1&D2B84C4F41445,1F2
6F90 1&42B2&F&B0B5B52,2B0
6FA0 1&5535331&4E5920,213
6FB0 1&4B5592&4&4&5228,218
6FC0 1&D4B4E55B0202B,1A2
6FD0 1&D4B4E55B0202B,1A2
6FE0 1B9C&B7D0B5&B&4C,2C1
6FF0 1&B0&7E&B7D&99&A2,446
7000 1&F2D4454E5352B29,1ED
7010 1B0B3455&2B54521,2B0
7020 1&5534&9542B42&1,24E
7030 1756&4B2&17146&B,292
7040 1&1B2B2B37352B42,1AF
7050 1&1756&4B2&2B2B3,1FC
7060 1&3B3B2B42&1756&4B,289
7070 1&3B3B2B42&1756&4B,289
7080 1&1756&4B5B3455&2B,253
7090 1&2454&3&54&9&4528,223
7&A0 1&2&17B54285214,2C3
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7100 1&5B2B2B4&1&E3E,4B9
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7120 1&B0B7E&B7D&99&A2,446
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7140 1&B0B7D3B&B7D&99&A2,446
7150 1&B0B7D3B&B7D&99&A2,446
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7&D0 1&B0B7D3B&B7D&99&A2,446
7&E0 1&B0B7D3B&B7D&99&A2,446
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7660 1&B0B7D3B&B7D&99&A2,446
7670 1&B0B7D3B&B7D&99&A2,446
7680 1&B0B7D3B&B7D&99&A2,446
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7&A0 1&B0B7D3B&B7D&99&A2,446
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7&C0 1&B0B7D3B&B7D&99&A2,446
7&D0 1&B0B7D3B&B7D&99&A2,446
7&E0 1&B0B7D3B&B7D&99&A2,446
7&F0 1&B0B7D3B&B7D&99&A2,446
7700 1&B0B7D3B&B7D&99&A2,446
7710 1&B0B7D3B&B7D&99&A2,446
7720 1&B0B7D3B&B7D&99&A2,446
7730 1&B0B7D3B&B7D&99&A2,446
7740 1&B0B7D3B&B7D&99&A2,446
7750 1&B0B7D3B&B7D&99&A2,446
7760 1&B0B7D3B&B7D&99&A2,446
7770 1&B0B7D3B&B7D&99&A2,446
7780 1&B0B7D3B&B7D&99&A2,446
7790 1&B0B7D3B&B7D&99&A2,446
7&A0 1&B0B7D3B&B7D&99&A2,446
7&B0 1&B0B7D3B&B7D&99&A2,446
7&C0 1&B0B7D3B&B7D&99&A2,446
7&D0 1&B0B7D3B&B7D&99&A2,446
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7810 1&B0B7D3B&B7D&99&A2,446
7820 1&B0B7D3B&B7D&99&A2,446
7830 1&B0B7D3B&B7D&99&A2,446
7840 1&B0B7D3B&B7D&99&A2,446
7850 1&B0B7D3B&B7D&99&A2,446
7860 1&B0B7D3B&B7D&99&A2,446
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7&B0 1&B0B7D3B&B7D&99&A2,446
7&C0 1&B0B7D3B&B7D&99&A2,446
7&D0 1&B0B7D3B&B7D&99&A2,446
7&E0 1&B0B7D3B&B7D&99&A2,446
7&F0 1&B0B7D3B&B7D&99&A2,446
7900 1&B0B7D3B&B7D&99&A2,446
7910 1&B0B7D3B&B7D&99&A2,446
7920 1&B0B7D3B&B7D&99&A2,446
7930 1&B0B7D3B&B7D&99&A2,446
7940 1&B0B7D3B&B7D&99&A2,446
7950 1&B0B7D3B&B7D&99&A2,446
7960 1&B0B7D3B&B7D&99&A2,446
7970 1&B0B7D3B&B7D&99&A2,446
7980 1&B0B7D3B&B7D&99&A2,446
7990 1&B0B7D3B&B7D&99&A2,446
7&A0 1&B0B7D3B&B7D&99&A2,446
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9140 1&3B3B2B42&1756&4B,289
9150 1&1756&4B5B3455&2B,253
9160 1&2454&3&54&9&4528,223
9170 1&2&17B54285214,2C3
9180 1&5B0B5B2AF475241,23D
9190 1&D2B84C4F41445,1F2
91A0 1&42B2&F&B0B5B52,2B0
91B0 1&5535331&4E5920,213
91C0 1&4B5592&4&4&5228,218
91D0 1&D4B4E55B0202B,1A2
91E0 1&D4B4E55B0202B,1A2
91F0 1B9C&B7D0B5&B&4C,2C1
9200 1&B0&7E&B7D&99&A2,446
9210 1&F2D4454E5352B29,1ED
9220 1B0B3455&2B54521,2B0
9230 1&5534&9542B42&1,24E
9240 1756&4B2&17146&B,292
9250 1&1B2B2B37352B42,1AF
9260 1&1756&4B2&2B2B3,1FC
9270 1&3B3B2B42&1756&4B,289
9280 1&3B3B2B42&1756&4B,289
9290 1&1756&4B5B3455&2B,253
92A0 1&2454&3&54&9&4528,223
92B0 1&2&17B54285214,2C3
92C0 1&5B0B5B2AF475241,23D
92D0 1&D2B84C4F41445,1F2
92E0 1&42B2&F&B0B5B52,2B0
92F0 1&5535331&4E5920,213
9300 1&4B5592&4&4&5228,218
9310 1&D4B4E55B0202B,1A2
9320 1&D4B4E55B0202B,1
```

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TOOLKIT

THERE ARE a number of Basic Programmer's Toolkits on the market for the ZX Spectrum. They all seem to have one or two absolutely brilliant functions, which are only used because they are there. Meanwhile, the normal toolkit functions are pretty ordinary and often not at all user-friendly. I have tried to compile a number of Toolkit functions which operate the way I want them to. I also decided to write a user-friendly System to link them all up. A tidy Menu Page is included as is a method of returning to the menu any time Input is requested.

Single-key entry and default values have been avoided. It is too easy to make a mistake and ruin a program. Every parameter is prompted for on screen. Most errors that can occur are trapped. There are a number of error messages.

A feature that will please many people is that if Open # 2, p or t is entered before calling the machine-code, the menu and prompts are still printed to the screen, but any Output — say, in Search and List, or List Variables — is sent to the selected channel.

The Editor: After much searching through Logan & O'Hara's book on the Spectrum Rom disassembly, I worked out how to call the internal Editor from machine-code. All Input is treated like Input Line — i.e. Caps 6 will return to Basic and no syntax check is made. Two added features are that the calling routine has to specify a length limit for any string, and that the empty string causes a return to the Menu. If the length limit is exceeded then the input is rejected and the editor is called again.

The Collect Number Routine: This uses the Editor to allow input up to five bytes. If any non-numeric characters are included, or the number is over 65535, then input is rejected and the Editor called again. Only positive whole numbers are allowed. If the first character is a " # ", then characters A-F or a-f are also allowed, and a hex number is evaluated.

The Parameter subroutine: This is a bit of code that when called, uses the bytes following the call as instructions. Compare the Spectrum Rom's floating-point calculator. It calls the editor for input, prints strings and numbers on screen, as well as ordinary letters and messages from a table. It places input into buffers, and when all the prompts have been answered, tests to see if the values are valid. If all is well, it then asks if the routine should be executed. If you answer Y or y then the work is done. Some individual routines have further tests and error traps inside them.

The Renumber functions: Because of the way these programs correct Goto line numbers, they should not be used with programs that contain machine-code in Rem lines.

R — Renumber block of program: Renumbers a specified block — Start and first unaffected line numbers — with a new base — Destination — and Increment as specified by the user. It makes sure that line numbers will not overlap. It corrects purely integer, simple and up to four-figure numbers after Goto, Gosub, Llist, Run, Restore, and Line — as in Save a$ Line 100 — throughout the entire program. It also removes leading zeros in

```
Listing 1.
100 REM PUT MACHINE CODE
110 CLEAR 5000
120 LET a=10: LET b=11: LET c=12: LET d=13: LET e=14:
LET f=15
130 LET line=1000
140 LET address=8000: line=line+1000:a=.4
150 RESTORE line
160 READ a$,sum
170 LET v=0
180 LET byte=LeVAL a$(1)+VAL a$(2)
190 LET byte=byte+byte
200 POKE address,byte
210 LET address=address+1
220 LET address=address+1
230 IF a$="ff" THEN GO TO 180
240 POKE 23692,255
250 IF sum<>v THEN PRINT "Line ";line;" Ok.";" LET l=
line+1: GO TO 150
260 PRINT "Checksum error in Line ";line
270 REM .4,-1,0: REM .4,-1,0
280 STOP
490 ERASE "a";"ii"Tool Load"
500 REM SAVE LOADER
510 SAVE "a";"ii"Tool Load"
520 VERIFY "a";"ii"Tool Load"
530 STOP
600 REM SAVE CODE
610 SAVE "a";"ii"Toolbytes"CODE 60000,5368
620 VERIFY "a";"ii"Toolbytes"CODE 60000,5368
630 STOP
1000 DATA "218B4E5E5D73CC5EFE5CD0EFED0202020202020202
020202020202020202020202020202020202020202020202020202
020202020202020202020202020202020202020202020202020202
1010 DATA "2184E5CD73CC5EFE5CD0EFED0202020202020202020
202020202020202020202020202020202020202020202020202020
202020202020202020202020202020202020202020202020202020
1020 DATA "4CA9A6E5D0AFCD0EFED0202020202020202020202020
202020202020202020202020202020202020202020202020202020
202020202020202020202020202020202020202020202020202020
1030 DATA "7A1637AF7D2202020202020202020202020202020202
020202020202020202020202020202020202020202020202020202
1040 DATA "2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A
2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A
1050 DATA "2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A
2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A
1060 DATA "2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A
2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A
1070 DATA "2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A
2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A
1080 DATA "2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A
2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A2A
1090 DATA "1F1F6A8FFE8A3B02C4B7C3EF15EFF81FF8D0CD2A190
1100 DATA "1F1F6A8FFE8A3B02C4B7C3EF15EFA6A8A5FFFF10
11BFCD2A191C9FFCD2A1A8FCD2A191C9FFCD2A191C9FFCD2A191
1200 DATA "0000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000000000
0000000000000
```

(continued from previous page)

depression will be taken as K mode. Symbol Shift A followed by just A will give Stop. This is useful in functions A and S, avoiding having to do Then keyword backspace Delete forwardspace.

N — Autoline Number: Prompts for Increment. When awaiting a Basic line to be entered, adds the Increment value to the existing current line and inserts that number in the Edit line. It only works if the last key pressed was Enter. It will very rarely append to a line after a syntax error — you'll just have to delete. Note that Q, T, W and X all turn this utility off.

Q — Constant memory: Gives a constant display of memory left. Is turned off by N, T, W and X.

T — Trace — Continuous display of current program line: This function prompts for speed. 100 is close to normal running speed. As the number is reduced, the program runs considerably slower. So if there is something wrong with your program you can get a rough idea why. When this function is in operation, you can skip through part of your program at normal speed by holding down Enter and K together. You can freeze the program by holding Enter and L together. Trace is turned off by N, Q, W and X.

X — Return interrupts to normal: Switches off N, Q, T and W. You can now New if you wish!

A — Search and replace: This prompts for Start and Finish line numbers. It then asks for Old and New strings. String in this sense means a string of characters from the program. They do not have to be the same length. There is also a List option (not advisable when there will be a large number of alterations). If the string to be altered contains floating point numbers, tell the program by preceding and following the number with three "&" signs. For example:

OLD STRING: *"m";&&&1&&&;" NEW STRING:"

would allow you to change Microdrive commands for tape. If "&&&" is part of a non-numeric string, this feature would not work further down the line. It also works in the New String. There is a maximum string length, including &'s, of 32 characters. To use the Bin character, place &&& before the Bin and after the bits. If the number is too large, a return to Basic is made with error 6. Error 4 is also possible but no damage will have been done.

B — Machine code to data: This prompts for start and finish addresses, a destination and number of bytes per line. Lines are formed incrementing by one. It gives the option of hex in the same form as line 1000 onwards in listing 1 or Decimal numbers. Only the hex form gives a checksum. A memory check is made before each line is started to ensure that the program is not corrupted by unfinished lines.

Error Reports.

Error message	May occur in
Task completed	Most routines: it means it's done as told
Range error	B, C, M, N, R, T, U. Increment > 100
Numbers reversed	A B C D J K L M P R - S. Start > Finish
Invalid line number	Line > 9996. Non-existent line in 0.
Zero not allowed	C M N R T U. Speaks for itself.
Lines would overlap	R. Check what you are trying to do.
No room at destination	B C E M. Not enough unused line numbers.
Zero block!	C D. No actual lines from start to finish

A check is also made to ensure that there are enough unused line numbers at the destination. Of course, machine code occupying the same space as the Toolkit will have to be moved before the Toolkit is loaded but that is simple enough.

U — UDGs to data: This is the same as function "B" but is an easier way of working if you want to put any UDGs — perhaps produced by function G — into Data lines. It asks for the number of UDGs required — starting from A — so 4 gives graphic A, B, C and D — and the number of the first Data line. It puts eight bytes on each line.

D — Delete block of program: This is obvious. Enter first line and finish line as prompted. It is very quick indeed.

E — Create a Rem line: This can create a Rem line of 35,000 characters in less than a second. Useful for those without Interface 1 who enter their machine code that way. Prompts for Line Number, Length, and Symbol.

F — Delete Rem lines: Prompts for Start and Finish line numbers. Deletes Rem lines in specified range only, including :Rem further down a line. Does not deal with If a Then Rem but who is that daft?

G — UDG Designer: Prompts for a character to be used as a starting point. This is then amended by entering the co-ordinates of a point on an 8 by 8 grid — number first — followed by i for fill in and o for rub out. Mirror images, inversions and rotations can also be made. Finally, the UDG is entered into a specified letter.

H — Hex/Decimal conversions: Will print any number input in both hex and decimal. As all numbers 0-65535 can be entered in either hex or decimal — see above under Collect Number routine — this is useful. It keeps prompting for more numbers. Return to menu using Empty String.

I — Status report: Gives a report of memory left, whether interrupts are normal or diverted, printout of UDGs provided channel s or p is in use, plus a few other bits. A command can be entered without returning to the menu.

J — Merge block of lines: Will merge together a specified block of lines as one line. Watch out for Goto destinations, Rem lines, and the fact that the Spectrum only allows 127 commands on a line.

K — Lower to upper case and L — upper to lower case: Will convert letters inside a program between two specified lines. Note that there is an option to include or exclude characters inside string quotes.

O — Token locate: This gives the address in both decimal and hex of the first symbol after the Line Number and Length Pointer in a specified line. Gives an error if the line does not exist.

P — Compact program: Does usual prompts for specified program block. Then deletes any unnecessary characters — i.e, spaces and colour controls outside quotes. It ignores lines that start with Rem but does affect messages after Rems if it is not the very first symbol on the line.

S — Search and List: This is the opposite to function A in how it deals with floating-point forms. It searches the lines and prints them in accordance with how they look when listed so you don't have to worry about hidden characters. It prompts for Start and Finish line numbers, and the string of characters to be searched for — maximum length 32.

V — List variables: Does what it says. All simple variables are given with their values, except that CHR$ 0-31 in string variables are printed as "?". For-Next variables are printed in capitals with their values, and Dimensioned variables are printed with their dimensions but no values.

Warning — Line 9999: If at any time there is an attempt to append to the existing program — i.e., creating lines after the last one present — using functions B, C, E, M or U, then although the functions will appear to work, the new lines will be formed in the variables area, and the computer will not work properly until you Clear it. Also Renumber relies on the fact that Line 9999 is present to ensure that if doesn't form invalid line numbers. So always ensure that at least Line 9999 is present in a program before using the Toolkit.

All prompts requiring line numbers actually reject anything above 9996. I append two suggested ideas for lines 9997 to 9999 depending on whether you are a Microdrive owner or not. Note that it is unwise to use Autorun on the Microdrive version as you would be unable to Merge the control lines with your existing program.

Lines 1000 upwards of listing 1 were produced by the toolkit. Type in listing 1. Save it by Run 500. Run the program. If all is well you will end up with Report E. Once okay, save it by Run 490 and save the Code also — Run 600. Rand USR 60000 should give you a nice title page. Use Caps 6 to return to Basic, then do a New then enter listing 2 or 3 as appropriate. Now Run 9997, then continue. ■

Listing 2.

```
  1
  2 REM Lines  9997-9999      are     referred to as :|
String 2 in     the text. Listing 3  is, of   course,
  the  first  program     on this tape!
  3
9997 STOP : ERASE "m";!;"Toolkit"; ERASE "m";!;"Toolby
tes": SAVE *"m";!;"Toolkit"; VERIFY *"m";!;"Toolkit";
SAVE *"m";!;"Toolbytes"CODE 60000,5368: VERIFY *"m";!;
"Toolbytes"CODE : STOP
9998 CLEAR 59999: LOAD *"m";!;"Toolbytes"CODE 60000: S
TOP
9999 RANDOMIZE USR 60000
```

Listing 3.

```
9997 STOP : SAVE "Toolkit" LINE 9998: SAVE "Toolbytes"
CODE 60000,5368: VERIFY "Toolkit": VERIFY "Toolbytes"C
ODE : STOP
9998 CLEAR 59999: LOAD "Toolbytes"CODE 60000: STOP
9999 RANDOMIZE USR 60000
```

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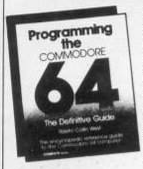

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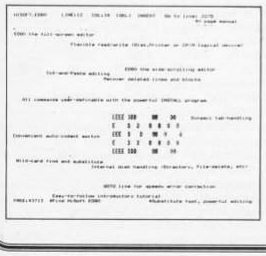

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THE AIM OF this and the next article is to describe the construction of a compiler system for BBC Basic that is suitable for use on the BBC and Electron computers. The limitations on the amount of memory available on these machines mean that it is not possible for the program to compile all of BBC Basic — instead only a subset is treated but this is more extensive than that handled by some commercially available compilers. This subset is shown in figure 1. I shall refer to it as TC — Tiny Compiled — Basic.

TC Basic consists of two programs; the compiler which is a large Basic program and the run time system — RTS — which is a hybrid machine code — Basic program. This article will describe the compiler while the subsequent one will contain a description of the assembly language program that generates the RTS: this is called the run time system generator — RTSG.

The aim of a compiler, is to convert a program written in a high-level language like BBC Basic into a much simpler one like machine code which will therefore run faster. A program compiled by the TC Basic compiler will run as fast as a Forth program — ie., four to five times faster than the usual interpreted BBC Basic.

The code version of a program is rather more compact than the original Basic program and, typically, at least 10K of code can be generated on a BBC micro — for the Electron 4K would be a reasonable estimate.

The compilers usually implemented on mainframe and minicomputers take the high-level program and convert it into machine code. However, for the BBC computer this approach has the disadvantage that the 6502 CPU chip does not have instructions to do many of the things one would like it to.

For instance, there are no instructions to add two 16 bit numbers or for multiplication. To get round this I have invented a "virtual machine". This is an idealised CPU which has instructions to do all the things required. It is implemented as a 6502 machine-code program. The compiler produces machine-code for this virtual machine; such code is usually called pseudo-code or more briefly, p-code.

The machine-code to interpret the p-code, is contained in the RTS and this is, of course, the main purpose of this program. The use of p-code has some advantages and some disadvantages. The chief advantage is that it makes the compiler and run time system a bit less complex. A further advantage is that compiled programs are very compact. The chief disadvantage is that p-code executes about three times slower than machine code.

An alternative to p-code would be to compile the Basic program into 6502 machine-code statements. Every time some feature not in the 6502 instruction set was required we could jump to a subroutine in a run time support system. Simple functions like addition could be implemented as in line code. The major advantage of this approach is that programs run faster. However, there is the disadvantage that programs are very long; perhaps three to four times the length of an equivalent p-code program.

All the components of a p-code system are used by a true machine-code compiler. It is therefore worth starting with such a system if you want to learn how to make a compiler work.

The TC Basic compiler is shown in the listing. Obviously, if you want a TC Basic system, begin by typing in this listing. It should be Saved before you try Running it. In addition, before you can declare the compiler finished, it is necessary to enter in line 120 the value of the address in memory of the top of the RTS. This number, is provided by the RTSG program to be described in part 2.

The following is a desciption of the major components of the compiler. The main program runs between lines 150 and 300. Line 150 calls Procsetup — line 560. This initialises the values of various variables; in particular, it gives a large number of them the values of the Basic tokens which correspond to the keywords the compiler needs to know about. Procsetup also calls Proctok — lines 380 to 540 — which assembles a small machine-code program which is used to print out keywords from their tokens in the listings of programs. In addition, Procsetup prompts the user to specify the sizes of various things and reserves the appropriate quantities of memory.

Line 160 is a call of Procopen — lines 940 to 1020 — which opens the file containing the program to be compiled. Once the file is open, characters are always read from it by using FNCH — line 1020. Line 170 set things up so that compilation can start and in line 180, the call of Procprog actually initiates the compilation process. After the program has been compiled, execution of the main program continues at line 190. Lines 190 to 210 check if the storage allocations have been exceeded and print error messages if this is the case.

At line 220, a check is made to see if there have been any errors so far. If there have, the program branches to line 290: this is where

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the compiler ends if there are errors; a message is printed out giving the number of errors.

At this point, the compiler has constructed a p-code version of the Basic program. However, there are no actual addresses in this for either variables or for Goto — or in p-code jump — statements to branch to. To complete the p-code program it must be "fixed up". This is done by Procfix — lines 4050 to 4230 — and its associated routines in lines 3950 to 4280. This procedure allocates memory to variables and finds out the addresses in code to which Gotos, procedures and functions correspond. While the code is being fixed up, it is also relocated so that it will run at the address corresponding to the top of the RTS. Hence the reason why the value of this must

Figure 1. TC Basic Specification

Variables:
2 byte signed integers.
Variable names may contain up to 255 characters and may end with a %. The variables A% to Z%, use the same memory locations as the usual Basic system variables thus allowing programs to pass information, and enabling parameter passing to the Call statement.
Arrays:
Multiple dimension arrays of 2 byte signed integers.
Arithmetic Operators: +, −, *, /, DIV, MOD
Logical Operators: AND, OR, EOR, NOT
Relational Operators: =, <, >, >=, <=, <>
Indirection Operator: ? (right hand side operand only)
Statements:
FOR to STEP NEXT (no variable allowed after NEXT)
REPEAT UNTIL
PRINT"string" ' variable / expression, TAB(X,Y) ;
IF THEN ELSE
VDU , ;
* string (send string to OSCLI)
GOTO line number
SOUND ENVELOPE
MODE GCOL COLOUR CLS CLG MOVE
DRAW PLOT
CALL END
DIM array / vairable
System variables / functions:
INKEY GET TRUE FALSE
ADVAL TIME ABS SGN
POS VPOS POINT SQR RND()
Procedures / functions:
DEFPROC PROC ENDPROC
DEFFN FN =
procedure and function arguments are not supported but procedures and functions can be used recursively.
In addition, the following are supported: REM, () (brackets), = (asignment), : (for multi-statement lines), integer constants, + and − (unary sign operators), & (for hex constants).

D J Piling with a compiler for the BBC.

PILER

Every time Proclx — lines 1230 to 1360 — is called, it reads the text token from the program and puts its type in the variable T%. Here "token" does not refer to the usual BBC Basic keyword token. Instead, it means the next significant piece of the program. Therefore, tokens can be variables and strings.

As was stated earlier, in a p-code system one constructs a virtual machine. In TC Basic the virtual machine is stack-based. This means that all operations take place either to or from the stack. For instance, there is an operation Add which takes a variable and adds it to the top element of the stack the result of the addition becoming the new top of stack element.

When the syntax analysis requires that a variable be added to the stack it calls Procadd. This writes the opcode for Add (2) into the code space and follows it with the address of the variable. In fact, until fix up instead of the variables address its number in the symbol table is used.

Other code generating subroutines, are supplied for all the operations the virtual machine is required to perform.

A typical scenario for the use of the compiler would be as follows: First, the program is developed as usual using the TC Basic subset to BBC Basic with the BBC Basic interpreter and Saved. Next, the compiler is Loaded and Run. It then asks for three pieces of information; the number of variables, the number of line numbers and the code space in bytes for the program to be compiled. Typically, answers of 100, 100 and 2000 would suffice for a small program. It is important to note that the number after a Goto counts as a variable as do the names of functions and procedures. Thus you must be careful when calculating how many variables to reserve space for.

Next, the compiler will ask you for the name of the program to be compiled. This will then be read in off the tape. This can in fact lead to a slight problem since, the compiler, is treating a program file as a data file. On a cassette-based system they are written to tape with different inter-block gaps. be known.

Finally, if no errors occur in the fix up process the compiler ends at line 260; this calls Procdump — lines 1040 to 1180 — to save the code produced.

Some other features of the compiler are worth describing. The procedures in lines 1230 to 1900 compose the lexical analyser.

This article is available on the Telsoft service.

With some cassette recorders having the wrong gap will lead to filing system errors when the program is being read in. The solution to this problem; if it happens to you, is to define one of the function keys as follows: *KEY0 *OPT,1 IIM INPUT '' "FILE NAME "A$:X% = OPENOUTA$: FORI% = PAGE TO TOP-1: BPUT#X%, ?I%: NEXT: CLOSE#X%: *OPT IIM

f0 is then used for saving programs to be compiled.

As the program is compiled, it will be listed out on the screen. If any errors are found there will be a break in the listing and an appropriate error message. If enough room has not been reserved for variables code or lines you will be informed of the amount of space needed for the.

Finally, if there are no errors in compilation, a copy of the code equivalent of the Basic program can be saved. This will automatically be given the name C.name-of-compiled-program.

To execute the program, this new code file must be loaded into the RTS. The construction of this will be described in part 2. A C30 containing the listings from both articles, TC Basic systems set up for both tape and disc based computers and example programs and code files is available from D. J. Pilling, 12 Cherrywood Avenue, Anchorsholme, Blackpool. FY5 1SU. in return for a cheque for £2.99.

```
  10REM ==============================
  20REM
  30REM TC BASIC COMPILER
  40REM D. J. Pilling
  50REM (c) January 1985
  60REM
  70REM ==============================
  80
  90REM enter value for top of RTS in
 100REM line 120.
 110
 120top=top%-7848
 130
 140MODE7:PROCT
 150PROCSETUP
 160PROCOPTS
 170TX=FNCH:A$=FNCH:PROCLX
 180PROCOPEN:CLOSE#IX
 190IF%L5%=L% PROCEM(5)
 200IF%EX%=EX% PROCEM(4)
 210IFEX%:CX=MCX PROCEM(6)
 220IFEN% GOTO290
 230PROCFIX
 240IFEN% GOTO290
 250
 260PROCONE:PROCDUMP
 270END
 280
 290PROCEE
 300END
 310
 320DEFFNL(B1%,B2%,B3%)
 330B3%=B3%:Z56=B2%-B4B48
 340IF(B1%MOD4)=0 B3%=B3%+16384+B1%=B1%+4
 350IF(B1%=4&4 B1%=&4 ELSEIFB1%=&54 B1%=8 ELSEIFB1%=&6
4 B1%=1?2 ELSEIFB1%=&74 B1%=128
 360=B1%+B3%
 370
 380DEFPROCTOK
 390IF?&6B1!5=&08%=&7FFl ELSE8%=&7FED
 400X%=&02ED:DIMTK 100
 410FOR?IX=BTO3TEP2:?IX=TX:?OPTI%
 420CMPC!28:BCCK%:BEQ LX
 430TAX:LDAE$XDIV25&:STA&71:LDAE$XMOD25&:STA&70:LDY(
26
 440.DS TXA:CMP(&70),Y:BEQ CX
 450INC &70:BNE DS:INC &71
 460LDA&71:CMP DXDIV25&:BNE DS
 470LDA&70:CMP DXMOD25&:BNE DS:BEQ FX
 480.CX LDX&0
 490.HX DEY:INX:LDA(&70),Y:CMPC!27:BCCH%
 500INY:INY:DEX:DEX:TXA:CMPE%:BCS FX
 510.EX LDA(&70),Y:JSR &FFEE:INY:BNE EX
 520.FX RTS:.RX JSR &FFEE:RTS
 530.LX LDAC&8:JSR &FFEE:LDAC7B:JSR &FFEE:LDAC&B:JSR
&FFEE:RTS:]:NEXT
 540ENDPROC
 550
 560DEFPROCSETUP
 570PROCTOK
 580PRINT'SELECT STORAGE ALLOCATIONS"
 590INPUT'"ENTER MAX. NUMBER OF LINES"'"NOT LESS THAN
10 ">"L%
 600IFL%<10GOTO590
 610INPUT'"ENTER NUMBER OF VARIABLES"'"BETWEEN 5 AND
256 ">"MC%
 620IF MX%>256 OR MX%<5 GOTO610
 630INPUT'"ENTER SIZE OF CODE SPACE IN BYTES"'"NOT LE
SS THAN 100 ">"MCX
 640IF MCX<100 GOTO630
 650DIM S$(MX%),B% 3*MX%,LX 4*MLX
 660B$=STRING$(48," ");B$=""
 670BNL%=B:NEX=B:BNX=B:ENX=B:EL%=B
 680DIM CX MCX:CX=CX+4
 690BNL%=top%-CX:H=MCX:MCX=4
 700?*=CX:EX=CX:MCX
 710for=&E3:top=&B0:step=&B0:next=&ED
 720vsum=&E2:print=&F1:lab=&B0:proc=&F2
 730end=&D0:endproc=&E1:rem=&F4
 740goto=&E5:and=&E8:inkey=&A4:if=&E7
 750else=&B8:int=&B2:then=&B8:=&DE
 760eq=&3D:gen=&11:leq=&2C:gt=&3E:lt=&3C
 770neq=&3A:lin=&28:r=&29:tr=&B9:fl=&A5
 780plus=&2B:minus=&2D:slash=&2F
 790times=&2A:pling=&3F:equot=&27
 800dquote=&22:comma=&2C:mod=&3B
 810call=&A4:spc=&22:mid=&D0:eop=&FF
 820peq=&11:neq=&2:neq=&3:id=&4:lb1=&5
 830cons1=&4:string=&7:rep=&F3:ont=&F3
 840mod=&E3:dim=&E1:sound=&D4:a=&B
 850and=&B8:or=&B4:eor=&B2:!=&A4
 860lim=&D11:ser=&91:pc=37:ap=38
 870mode=&E3:el=&D8:clg=&D4:gcol=&E6
 880col=&F3:draw=&F1:move=&E2:plot=&F8
 890rnd=&E3:sgn=&B4:sqr=&B4:abs=&94
 900get=&A5:adv=&9A:pos=&B1:vpo=&BC
 910pos=&B8:call=&D4:not=&AC:ln=&E2
 920END?PROC
 930
 940DEFPROCOPEN
 950=OPT1,1
 960=OPT2,1
 970PRINT''"ENTER NAME OF PROGRAM TO"
 980INPUT'"COMPILE ">"F$
 990IX=OPENUPF$
 1000PRINT''"START OF COMPILATION"''
 1010=OPT1,0
 1020ENDPROC
 1030
 1040DEFPROCDUMP
 1050IFLEN#>0 F$=LEFT$(F$,8)
 1060F$+"C."+F$
 1070PRINT''"READY TO SAVE CODE";F$
 1080PRINT"SAVE CODE ? Y/N ";
 1090IX=BGET:IF IX=ASC"Y" ELSEIF IX=ASC"N"GOTO1170 ELSE
1090
 1100PRINT''
 1110=OPT1,1
 1120IX=OPENOUTF$
 1130PRINTEX%,CX,FX,EX,F$
 1140FOR IX=CX-4 TO EX:BPUTEX%,?IX:NEXT
 1150CLOSE#IX
 1160GOTO1070
 1170=OPT
 1180PRINT''ENDPROC
 1190
 1200DEFFNCH:=BGETE%
 1210DEFPROCA:CALL TK:A%=FNCH:ENDPROC
 1220
 1230DEFPROCL:
 1240IFL% TX=B:ENDPROC
 1250IFTX=eop:ENDPROC
 1260IFTX=eol% PROCNL
 1270IFA$=apc:REPEAT PROCA:UNTILA%()=apc
 1280IFNOTFNNL(A%) GOTO1320
 1290PROCIS:IFA%=pc B#=B#+"X":PROCA
 1300IF(A%=lb TX=ar ELSETX=id
 1310PROCB:ENDPROC
 1320IFA%()pro& AND&X()fn GOTO1350
 1330TX=A%:PROCA:IFNOTFNNL(A%) TX=B:ENDPROC
 1340PROCIS:PROCB:ENDPROC
 1350IF FNDN(A%) PROCDN8 ELSEIF A%=up PROCA:PROCHN8 EL
SEIF A%=rem PROCR8 ELSEIF A%=dquote PROC8G ELSEIF A%=l
ine PROCL8 ELSEPROCT8
 1360ENDPROC
 1370DEFFNNL(A%):=(A%)&4AND&5(91)OR(A%)?&AND&5(123)
 1380DEFFNDN(A%):=(A%)&7AND&5(58)
 1390DEFFNHN(A%):=(A%)&7AND&5(58)OR(A%)&4AND&5(71)
 1400DEFPROCL8
```

(listing continued on next page)

(listing continued from previous page)

```
141BNX=FNL(FNCH,FNCH,FNCH)
142BNX=INT(NX)+FNCH$#=STR$NX
143PROC0
144PRINT[NL]
145ENDPROC
146ADEPROCIG
147B$#="":REPEAT1$#=$#+CHR$AX;PROCA:UNTIL NOT!FNDN(AX
148ENDPROC
149BTX=const
150ENDPROC
151BEPROCNHNG
152NN=$#:REPEAT NX=NX+16
153IFFNDN(AX) NX=NX+AX-ABC"B":PROCA ELBEIFFNNN(AX) N
154BUNTIL!NOT!FNNN(AX)
157B?!=const
158ENDPROC
159BCEPROCRG
160BFEPEAT PROCA:UNTILAX=mein:TX=AX;PROCA
161BGENDPROC
162B$=""
164BHEPEAT:$#=$#+CHR$AX;VDUAX;AX=FNCH:UNTIL AX=mouse
165BIFAX=mein:IFAX=mein:PROCM(1) ELBE PROCA
166BJEnd-string
167BNENDPROC
168BOEPROCCLIO
169BBE=CHR$AX
170BNEEPEAT:PROCA:$#=$#+CHR$AX;UNTIL AX=mein:TX=AX;PRO
CA
171BNENDPROC
172BDEPROCT0
173BTX=AX;PROCA
174BIIFNT*mg1 ANDAX=mg TX=mg:PROCA
175BIFTX=1 ANDAX=mg TX=1:PROCA
176BJIFTX=1 ANDAX=mg TX=mg:PROCA
177BIFTX=0 ANDAX=0:ELBE PROCA
AX(-AX)
178BIFTX=0 ANDAX=mein:TX=AX:PROCA
179BONPROC
180BDEPROCOL
181BIFAX=mog:ENDPROC
182BJFNX=NX+25A=FNCH:LLX=FNCH
183BLFNLX=NLX ENX=ENX+1:BOTO1888
184BLLX=(NLX+4)-1:X2D=255A
185BLLX=(NLX+4)-1.X2MOD256A
186BLX=(NLX+4)-2*X2D=255A
187BLX=(NLX+4)-2*X2MOD256A
188BNLX=NLX-1
189BPRINT;LIX; TAB(4);AX=32
190BPROC
191B
192BDEPROCS
193BIF NEX>NBX ENX=ENX+1:ENDPROC
194BBNX=:REPEAT BNX=BNX+1
195BUNTIL !B#(BNX)=B# AND BX?(3+BNX)=TX; OR B#(BNX)=""
196BIFB#(BNX)="" B#(BNX)=B#:BX?(3+BNX)=TX:BX?(3+BNX)=TX:B
X?(3+BNX)=1:B?(3+BNX)=2:B=B
197BENDPROC
198B
199BDEPROCprog
200BIFTX=mop PROCEND:ENDPROC
201BPROCstate:IFTX=col ORTX=mein PROCL:BOTO2888
202BENDPROC
203BDEPROCdef:PROCEND
204BPROCL:IFTX<>proc ANDTX<>fn PROCC(proc)
205BOBX=(3+BNX+1)-MOD1V256
206BOBX=(3+BNX+2)-MXMOD256A
207BTX=fn ENDPROC:BOTO2128
208BPROCL
209BIFTX=mop ORTX=endproc BOTO2118
210BPROCstate:IFTX=col ORTX=mein PROCL:BOTO2898
211BPROC(endproc):PROCL:ENDPROC
212BIFTX=mop ORTX=mg BOTO2148
213BPROCstate:IFTX=col ORTX=mein PROCL:BOTO2128
214B PROC(mg):PROCL;PROCmg:PROCRTF:ENDPROC
215B
216BDEPROCstate
217BIFTX=mein ORTX=mise:BOTO2458
218BIFTX=lio PROCassign:BOTO2458
219BIFTX=or PROCassign:BOTO2458
220BIFTX=plng PROCassign:BOTO2458
221BIFTX=mod PROCassign:BOTO2458
222BIFTX=proc PROCproc:BOTO2458
223BIFTX=sp PROCsp:BOTO2458
224BIFTX=vbu PROCvbu:BOTO2458
225BIFTX=if PROCif:BOTO2458
226BIFTX=for PROCfor:BOTO2458
227BIFTX=goto PROCgoto:BOTO2458
228BIFTX=rt PROCrt:BOTO2458
229BIFTX=end PROCend:BOTO2458
230BIFTX=mod PROCmod:BOTO2458
231BIFTX=bound PROCbound:BOTO2458
232BIFTX=mod PROCmv:BOTO2458
233BIFTX=call PROCcal:BOTO2458
234BIFTX=dim PROCdim:BOTO2458
235BIFTX=times PROCtimes:BOTO2458
236BIFTX=mode PROCmode:BOTO2458
237BIFTX=colo PROCcolo:BOTO2458
238BIFTX=gcol PROCgcol:BOTO2458
239BIFTX=move PROCmove:BOTO2458
240BIFTX=draw PROCdraw:BOTO2458
241BIFTX=plot PROCplot:BOTO2458
242BIFTX=cls PROCcls:BOTO2458
243BIFTX=vdu PROCvdu(12):BOTO2458
244BPROCEN(7):PROCEN(16):BOTO2458
245BPROCL:PROCL
246BIF(TX=lexn ANDTX<>col ANDTX<>else) PROCEN(7):PRO
CEL
247BENDPROC
248B
249BDEPROCend:PROCEND:PROCL:ENDPROC
250BDEPROCassign:LOCALBTX:BTX=BNX
251BPROCL:PROCC(mg):PROCL(PROCmg)
252BPROCassign:PROCL(PROCmg)
253BDEPROCassignLOCALBTX:BTX=BNX
254BPROCL:PROCC(mg):PROCL(PROCmg)
255BPROCassign:PROCL(PROCmg)
256BDEPROCsp:PROCL:ENDPROC
257BDEPROCvbu:PROCL:ENDPROC
258BDEPROCif:PROCL:ENDPROC
259BDEPROCfor:PROCL:ENDPROC
260BDEPROCgoto:PROCL:ENDPROC
261BDEPROCrt:PROCL:ENDPROC
262BDEPROCend:PROCL:ENDPROC
263BDEPROCmod:PROCL:ENDPROC
264BDEPROCmv:PROCL:ENDPROC
265BDEPROCcal:PROCL:ENDPROC
266BDEPROCdim:PROCL:ENDPROC
267BDEPROCtimes:PROCL:ENDPROC
268BDEPROCmode:PROCL:ENDPROC
269BDEPROCcolo:PROCL:ENDPROC
270BDEPROCgcol:PROCL:ENDPROC
271BDEPROCmove:PROCL:ENDPROC
272BDEPROCdraw:PROCL:ENDPROC
273BDEPROCplot:PROCL:ENDPROC
274BDEPROCcls:PROCL:ENDPROC
275BDEPROCvdu:PROCL(12):BOTO2458
276BPROCEN(7):PROCEN(16):BOTO2458
277BDEPROCstate
278BIFTX=col PROCL:BOTO2788
279BIFTX=mise PROCL:BOTO2788
280BIFTX=lio PROCL:BOTO2788
281BIFTX=or PROCL:BOTO2788
282BIFTX=plng PROCL:BOTO2788
283BIFTX=mod PROCL:BOTO2788
284BIFTX=proc PROCL:BOTO2788
285BIFTX=sp PROCL:BOTO2788
286BIFTX=vbu PROCL:BOTO2788
287BIFTX=if PROCL:BOTO2788
288BIFTX=for PROCL:BOTO2788
289BIFTX=goto PROCL:BOTO2788
290BIFTX=rt PROCL:BOTO2788
291BIFTX=end PROCL:BOTO2788
292BIFTX=mod PROCL:BOTO2788
293BIFTX=mv PROCL:BOTO2788
294BIFTX=cal PROCL:BOTO2788
295BIFTX=dim PROCL:BOTO2788
296BIFTX=times PROCL:BOTO2788
297BIFTX=mode PROCL:BOTO2788
298BIFTX=colo PROCL:BOTO2788
299BIFTX=gcol PROCL:BOTO2788
300BIFTX=move PROCL:BOTO2788
301BIFTX=draw PROCL:BOTO2788
302BIFTX=plot PROCL:BOTO2788
303BIFTX=cls PROCL:BOTO2788
304BIFTX=vdu PROCL(12):BOTO2788
305BPROCEN(7):PROCEN(16):BOTO2788
306BIFTX=mod PROCL:BOTO2788
307BIFTX=mv PROCL:BOTO2788
308BIFTX=cal PROCL:BOTO2788
309BIFTX=dim PROCL:BOTO2788
310BIFTX=times PROCL:BOTO2788
311BIFTX=mode PROCL:BOTO2788
312BIFTX=colo PROCL:BOTO2788
313BIFTX=gcol PROCL:BOTO2788
314BIFTX=move PROCL:BOTO2788
315BIFTX=draw PROCL:BOTO2788
316BIFTX=plot PROCL:BOTO2788
317BIFTX=cls PROCL:BOTO2788
318BIFTX=vdu PROCL(12):BOTO2788
319BPROCEN(7):PROCEN(16):BOTO2788
320BIFTX=mod PROCL:BOTO2788
321BIFTX=mv PROCL:BOTO2788
322BIFTX=cal PROCL:BOTO2788
323BIFTX=dim PROCL:BOTO2788
324BIFTX=times PROCL:BOTO2788
325BIFTX=mode PROCL:BOTO2788
326BIFTX=colo PROCL:BOTO2788
327BIFTX=gcol PROCL:BOTO2788
328BIFTX=move PROCL:BOTO2788
329BIFTX=draw PROCL:BOTO2788
330BIFTX=plot PROCL:BOTO2788
331BIFTX=cls PROCL:BOTO2788
332BIFTX=vdu PROCL(12):BOTO2788
333BPROCEN(7):PROCEN(16):BOTO2788
334BIFTX=mod PROCL:BOTO2788
335BIFTX=mv PROCL:BOTO2788
336BIFTX=cal PROCL:BOTO2788
337BIFTX=dim PROCL:BOTO2788
338BIFTX=times PROCL:BOTO2788
339BIFTX=mode PROCL:BOTO2788
340BIFTX=colo PROCL:BOTO2788
341BIFTX=gcol PROCL:BOTO2788
342BIFTX=move PROCL:BOTO2788
343BIFTX=draw PROCL:BOTO2788
344BIFTX=plot PROCL:BOTO2788
345BIFTX=cls PROCL:BOTO2788
346BIFTX=vdu PROCL(12):BOTO2788
347BPROCEN(7):PROCEN(16):BOTO2788
348BENDPROC
349BDEPROCprc
350BIFTX=mein PROCL:PROCFactor ELBEIFTX=minus PROCL:
PROCFactor:PROCNEG ELBE PROCFactor
351BENDPROCFactor
352BDEPROCbound
353BPROCL:PROCC(mg):PROCL(PROCmg)
354BPROCL:PROCC(mg):PROCL(PROCmg)
355BPROCL:PROCC(mg):PROCL(PROCmg)
356BPROCL:PROCC(mg):PROCL(PROCmg):ENDPROC
357BDEPROCmv
358BLOCAL:IF IX=1TO3
359BPROCL:PROCC(mg):PROCL(PROCmg)
360BPROCL:PROCC(mg):PROCL(PROCmg)
361BPROCL:PROCC(mg):PROCL(PROCmg)
362BDEPROCcal:PROCL:PROCC(mg):PROCCAL:ENDPROC
363BPROCL:IF!X?&r BOTO3468
364BTX=AX:IF BX?(BNX+1)<0 PROCEN(8):PROCEL:ENDP
ROC
365BPROCgna:PROCL(BX?(BTX+3*2)):PROCMA:PROCAR(PX-3,BTX)
:BTX=BX?(BTX+3)+1:PROCMA:PROCAR(PX-3,BTX)
366BIFTX=lexn PROCL:PROCEN(7)
367BBTX=BNX:PROCL:PROCC(mg):PROCDM:PROCAR(PX-3,BTX)
368BENDPROCdim
369BDEPROCtimes
370BPROCL:PROCgna:PROCL 1
371BPROCL:PROCC(mg):PROCL(PROCmg):IF!X=B:IX=1:BOTO374
0
372BREPEAT IX=IX-1:PROCL:IF!IX<B PROCC(comma):PROCL
(PROCmg)
373BUNTIL!IX=B:PROCC(rb):PROCL:ENDPROC
374BPROCL:IFTX=comma IX=IX+1:BOTO3748
375BIFTX=lexn IX=IX+1:BOTO3748 ELSEPR
OCC(rb):PROCL:IFTX=3:IX=IX+1:BOTO3748 ELSEPR
376BDEPROCmode:PROCL:PROCC(mg):PROCL(PROCmg)
:ENDPROC
377BDEPROCcolo:PROCL:PROCC(mg):PROCL(22):PROCDVU:EN
DPROC
378BDEPROCgcol:PROCL:PROCC(mg):PROCL(17):PROCDVU:EN
DPROC
379BDEPROCmove:PROCL:PROCC(mg):PROCL(18):PROCDVU:PR
OCL:PROCC(mg):PROCL(PROCmg):PROCDVU:ENDPROC
380BDEPROCdraw:PROCL:PROCC(mg):PROCL(25):PROCDVU:PR
OCL:PROCC(mg):PROCL(PROCmg):PROCDVU:ENDPROC
381BDEPROCplot:PROCL:PROCC(mg):PROCL(24):PROCDVU:PR
OCL:PROCC(mg):PROCL(PROCmg):PROCDVU:ENDPROC
382BDEPROCcls:PROCL:PROCVDL(25):PROCVL(4):PROCDVU:
PROCVDL(PROCmg):PROCL(PROCmg):PROCVDU:ENDPROC
383BDEPROCvdu:PROCL:PROCC(mg):PROCL(5):PROCDVU:
PROCL(PROCmg):PROCL(PROCmg):PROCVDU:ENDPROC
384BIFTX=mod ORTX=mv BOTO3848
385BIFTX=cal ORTX=dim PROCL:PROCL(3):PROCD3828
386BIFTX=times:PROCL:PROCL(PROCmg)
387BIFTX=mode ORTX=colo ORTX=gcol ANDTX<>mg ANDTX<>m
ise ORTX=mod ORTX=mv ORTX=cal ORTX=dim ORTX=mv
ORTX=times ORTX=mode ORTX=colo ORTX=gcol ANDTX<>mg
ELBEIFTX=mise PROCMD
388BIFTX=lio PROCL:PROCC(mg):PROCL(PROCmg)
389BIFTX=or PROCL:PROCC(mg):PROCL(PROCmg)
390BIFTX=plng PROCL:PROCC(mg):PROCL(PROCmg)
391BIFTX=proc PROCL:PROCC(mg):PROCL(PROCmg)
392BIFTX=sp PROCL:PROCC(mg):PROCL(PROCmg)
393BIFTX=vbu PROCL:PROCC(mg):PROCL(PROCmg)
394BENDPROC
395BDEPROCmv:PROCL:PROCC(mg):PROCL(PROCmg)
396BIFTX=mod PROCL:PROCC(mg):PROCL(PROCmg)
397BIFTX=cal PROCL:PROCC(mg):PROCL(PROCmg)
398BIFTX=dim PROCL:PROCC(mg):PROCL(PROCmg)
399BIFTX=times PROCL:PROCC(mg):PROCL(PROCmg)
400BIFTX=mode PROCL:PROCC(mg):PROCL(PROCmg)
401BIFTX=colo PROCL:PROCC(mg):PROCL(PROCmg)
402BIFTX=gcol PROCL:PROCC(mg):PROCL(PROCmg)
403BIFTX=move PROCL:PROCC(mg):PROCL(PROCmg)
404BIFTX=draw PROCL:PROCC(mg):PROCL(PROCmg)
405BIFTX=plot PROCL:PROCC(mg):PROCL(PROCmg)
406BIFTX=cls PROCL:PROCC(mg):PROCL(PROCmg)
407BIFTX=vdu PROCL:PROCC(mg):PROCL(PROCmg)
408BENDPROCcal
409BDEPROCdim:PROCL:PROCC(mg):PROCL(PROCmg)
410BIFTX=mise PROCL:PROCC(mg):PROCL(PROCmg)
411BIFTX=lio PROCL:PROCC(mg):PROCL(PROCmg)
412BIFTX=or PROCL:PROCC(mg):PROCL(PROCmg)
413BIFTX=plng PROCL:PROCC(mg):PROCL(PROCmg)
414BIFTX=mod PROCL:PROCC(mg):PROCL(PROCmg)
415BIFTX=proc PROCL:PROCC(mg):PROCL(PROCmg)
416BIFTX=sp PROCL:PROCC(mg):PROCL(PROCmg)
417BIFTX=vbu PROCL:PROCC(mg):PROCL(PROCmg)
418BIFTX=if PROCL:PROCC(mg):PROCL(PROCmg)
419BIFTX=for PROCL:PROCC(mg):PROCL(PROCmg)
420BIFTX=goto PROCL:PROCC(mg):PROCL(PROCmg)
421BIFTX=rt PROCL:PROCC(mg):PROCL(PROCmg)
422BIFTX=end PROCL:PROCC(mg):PROCL(PROCmg)
423BIFTX=mod PROCL:PROCC(mg):PROCL(PROCmg)
424BIFTX=mv PROCL:PROCC(mg):PROCL(PROCmg)
425BIFTX=cal PROCL:PROCC(mg):PROCL(PROCmg)
426BIFTX=dim PROCL:PROCC(mg):PROCL(PROCmg)
427BIFTX=times PROCL:PROCC(mg):PROCL(PROCmg)
428BIFTX=mode PROCL:PROCC(mg):PROCL(PROCmg)
429BIFTX=colo PROCL:PROCC(mg):PROCL(PROCmg)
430BIFTX=gcol PROCL:PROCC(mg):PROCL(PROCmg)
431BIFTX=move PROCL:PROCC(mg):PROCL(PROCmg)
432BIFTX=draw PROCL:PROCC(mg):PROCL(PROCmg)
433BIFTX=plot PROCL:PROCC(mg):PROCL(PROCmg)
434BIFTX=cls PROCL:PROCC(mg):PROCL(PROCmg)
435BIFTX=vdu PROCL:PROCC(mg):PROCL(PROCmg)
436BENDPROCmod
437BDEPROCmv:PROCL:PROCC(mg):PROCL(PROCmg)
438BIFTX=cal PROCL:PROCC(mg):PROCL(PROCmg)
439BIFTX=dim PROCL:PROCC(mg):PROCL(PROCmg)
440BIFTX=times PROCL:PROCC(mg):PROCL(PROCmg)
441BIFTX=mode PROCL:PROCC(mg):PROCL(PROCmg)
442BIFTX=colo PROCL:PROCC(mg):PROCL(PROCmg)
443BIFTX=gcol PROCL:PROCC(mg):PROCL(PROCmg)
444BIFTX=move PROCL:PROCC(mg):PROCL(PROCmg)
445BIFTX=draw PROCL:PROCC(mg):PROCL(PROCmg)
446BIFTX=plot PROCL:PROCC(mg):PROCL(PROCmg)
447BIFTX=cls PROCL:PROCC(mg):PROCL(PROCmg)
448BIFTX=vdu PROCL:PROCC(mg):PROCL(PROCmg)
449BENDPROCcal
450BDEPROCdim:PROCL:PROCC(mg):PROCL(PROCmg)
451BIFTX=mise PROCL:PROCC(mg):PROCL(PROCmg)
452BIFTX=lio PROCL:PROCC(mg):PROCL(PROCmg)
453BIFTX=or PROCL:PROCC(mg):PROCL(PROCmg)
454BIFTX=plng PROCL:PROCC(mg):PROCL(PROCmg)
455BIFTX=mod PROCL:PROCC(mg):PROCL(PROCmg)
456BIFTX=proc PROCL:PROCC(mg):PROCL(PROCmg)
457BIFTX=sp PROCL:PROCC(mg):PROCL(PROCmg)
458BIFTX=vbu PROCL:PROCC(mg):PROCL(PROCmg)
459BIFTX=if PROCL:PROCC(mg):PROCL(PROCmg)
460BIFTX=for PROCL:PROCC(mg):PROCL(PROCmg)
461BIFTX=goto PROCL:PROCC(mg):PROCL(PROCmg)
462BIFTX=rt PROCL:PROCC(mg):PROCL(PROCmg)
463BIFTX=end PROCL:PROCC(mg):PROCL(PROCmg)
464BIFTX=mod PROCL:PROCC(mg):PROCL(PROCmg)
465BIFTX=mv PROCL:PROCC(mg):PROCL(PROCmg)
466BIFTX=cal PROCL:PROCC(mg):PROCL(PROCmg)
467BIFTX=dim PROCL:PROCC(mg):PROCL(PROCmg)
468BIFTX=times PROCL:PROCC(mg):PROCL(PROCmg)
469BIFTX=mode PROCL:PROCC(mg):PROCL(PROCmg)
470BIFTX=colo PROCL:PROCC(mg):PROCL(PROCmg)
471BIFTX=gcol PROCL:PROCC(mg):PROCL(PROCmg)
472BIFTX=move PROCL:PROCC(mg):PROCL(PROCmg)
473BIFTX=draw PROCL:PROCC(mg):PROCL(PROCmg)
474BIFTX=plot PROCL:PROCC(mg):PROCL(PROCmg)
475BIFTX=cls PROCL:PROCC(mg):PROCL(PROCmg)
476BIFTX=vdu PROCL:PROCC(mg):PROCL(PROCmg)
477BENDPROCmv
478BDEPROCmod
479BIFTX=cal PROCL:PROCC(mg):PROCL(PROCmg)
480BENDPROC
481BDEPROCdim
482BDEPROCmode:PROCL:PROCC(mg):PROCL(PROCmg)
483BDEPROCcolo:PROCL:PROCC(mg):PROCL(PROCmg)
484BDEPROCgcol:PROCL:PROCC(mg):PROCL(PROCmg)
485BDEPROCmove:PROCL:PROCC(mg):PROCL(PROCmg)
486BDEPROCdraw:PROCL:PROCC(mg):PROCL(PROCmg)
487BDEPROCplot:PROCL:PROCC(mg):PROCL(PROCmg)
488BDEPROCcls:PROCL:PROCC(mg):PROCL(PROCmg)
489BDEPROCvdu:PROCL:PROCC(mg):PROCL(PROCmg)
490BENDPROCmod
491BDEPROCmv:PROCL:PROCC(mg):PROCL(PROCmg)
492BDEPROCcal:PROCL:PROCC(mg):PROCL(PROCmg)
493BDEPROCdim:PROCL:PROCC(mg):PROCL(PROCmg)
494BDEPROCtimes:PROCL:PROCC(mg):PROCL(PROCmg)
495BIFPX<CE OR PX>2*EX ENDPROC
496BPRT?3=ASD1V256
497BPRT?4=MXMOD256A
498BENDPROC
499B
500BDEPFNC(BX)
501BIFPX>EX ENX=ENX+1:EX=PX:BX=FALSE ELBE:=TRUE
502BDEPROCERT:PRINT"ERROR";TX TO CONTINUE ";REPEAT U
NTIL INKEY(-14):PRINT:ENDPROC
503BDEPROCERR:PRINT
504BDEPROCERR
505BIF!X=1 PRINT"missing "
506BIF!X=2 PRINT"no such line number ";B#(BNX)
507BIF!X=3 PRINT"no such fn/proc ";B#(BNX)
508BIF!X=4 PRINT"too many variables"
509BIF!X=5 PRINT"program needs ";MLX;' lines'
510BIF!X=6 PRINT"program needs ";2*MCX+CE-EX;" bytes
"
511BIF!X=7 PRINT"syntax error "
512BIF!X=8 PRINT"array already dim'd"
513BIF!X=9 PRINT"array ";B#(BNX);" not dim'd"
514BENDPROCERR
515BDEPROCIS(BX)
516BIF!X=0 ENDPROC
517BIF!X=2 ENDPROC
518BPRINT"missing ";
519BELSE:IF!X=1:X=0:
520BIFAX1>32 ANDAX<>lino THEN CALL TK ELBEIFAX=id PRIN
T"id / variable";ELBEIFAX=ar PRINT"array dim";ELBEIFA
X=[ PRINT"expression";ELBEIFAX=lino PRINT"line number
";
521BAX=TX:ENDPROC:IFTX=TX:TX=B:PROCERT:ENDPROC
522BIFTX=lexn OR ELX=mop TX=ELX:ELX=FALSE:ENDPROC
523BELSEIFTX=lexn PRINT"EXPECTED";:ELX=FALSE:ENDPROC
524BENDPROC
525BDEPROCIT
527BPRINT"";ENX;' ERRORS - COMPILATION STOPPED"
528BENDPROC
529BDEPRINT "COMPILATION COMPLETE"
530BENDPROC
532BDEPROCT
533BPOP13=BTO33
534BVDU129+(IX/2)MOD5;IX?;141;135
535BPRINT"T.C. BASIC COMPILER >>>"
537BENDPROC
```

```
X+1)+IX DIV256A:BX?(BXX+2)=IX MOD256A:ENDPROC
397BBX?(BXX+1)=PX DIV256A:BX?(BXX+2)=PX MOD256A:ENDP
ROC
398BDEPROCAF(IX(BXX)
399BIFIX(BXX+1)=0 PROCEN(9)
400BBX?(BXX+1)=PX DIV256A:BX?(BXX+2)=PX MOD256A:ENDP
ROC
401BDEPROCPF(IX(BXX):IFBX?(BXX+1)=0 PROCEN(3)
402BENDPROC
403BDEPROCFI(IX(BXX):IFBX?(BXX+1)=0 PROCEN(3)
404BENDPROC
405BDEPROCIF
406BPRINT"FIX UP STAGE"
407BEXP=PX:BNX=0:REPEAT
408BIFBX?(3+BNX)=1:ins PROCFIX(3+BNX)
409BIFBX?(3+BNX)=0 PROCFIX(3+BNX) ELBEIFBX?(3+BNX)=
AF PROCAF(3+BNX)
410BBNX=BNX+1:BNX=BNX:PROCFIX(3+BNX)
411BIFBX?(3+BNX)=fn:PROCFIX(3+BNX)
412BBNX=BNX+1:UNTILB#(BNX)=""
413BFX=MCX:REPEAT:PX?FX:IFB#(BNX)=B#:PRINT
414BFX=FX-1:UNTIL FX=EX:IFB#(BNX)=B# PX=PX+1:ENDPROCIF
415BIFIX(4DPIX)=B# PX=PX+(PX?-2)-1:BOTO4218
416BIFIX=7480TO4218 ELBEPX=PX+3
417BIFIX=9 PX=PX+2:PX=PX+(PX?-2)-1:BOTO4218
418BOOPX=2:PX?-1=BX?(BXX+3+1):PX?-2=BX?(BXX+3+2)
420BPROCL
421BUNTIL PX=EX
422BPRINT"FIX UP NON COMPLETE"
423BENDPROC
424BDEPROCL
426BPX=256*PX?-1+PX?-2
428BIFNX<NBX ENX=ENX-1:BNX=BNX+1:ENDPROC
429BPX?-1=NXDIV256A:PX?-2=NXMOD256A
430B
430BDEPROCDOP:PROCP(1,2):ENDPROC
431BDEPROCDUB:PROCP(1,4):ENDPROC
432BDEPROCDIV:PROCP(1,6):ENDPROC
433BDEPROCDCT1:PROCP(1,8):ENDPROC
434BDEPROCDCT2:PROCP(1,10):ENDPROC
435BDEPROCDCT3:PROCP(1,12):ENDPROC
436BDEPROCDEG:PROCP(1,14):ENDPROC
437BDEPROCDEC:PROCP(1,16):ENDPROC
438BDEPROCDEU:PROCP(1,18):ENDPROC
439BDEPROCDEB:PROCP(1,20):ENDPROC
440BDEPROCDVU:PROCP(1,22):ENDPROC
441BDEPROCDIN:PROCP(1,24):ENDPROC
442BDEPROCDIS:PROCP(1,26):ENDPROC
443BDEPROCDIL:PROCP(1,28):ENDPROC
444BDEPROCDIT:PROCP(1,30):ENDPROC
445BDEPROCDIP:PROCP(1,32):ENDPROC
446BDEPROCDIM:PROCP(1,34):ENDPROC
447BDEPROCDIF:PROCP(1,36):ENDPROC
448BDEPROCDVD:PROCP(1,44):ENDPROC
449BDEPROCDVD:PROCP(1,46):ENDPROC
450BDEPROCDP(BX,CX)
451BIFPX(BX) PX=CX:PX=PX+BX
452BENDPROC
453BDEPROCVL(LX):IFPX(3)=?PX=4B:PX?(PX+LX)=PX+PX+2
454BENDPROC
455BDEPROCBND:PROCP(1,58):ENDPROC
456BDEPROCBT1:PROCP(1,52):ENDPROC
457BDEPROCBT2:PROCP(1,54):ENDPROC
458BDEPROCBND:PROCP(1,56):ENDPROC
459BDEPROCDR:PROCP(1,38):ENDPROC
460BDEPROCDR1:PROCP(1,40):ENDPROC
461BDEPROCDR2:PROCP(1,42):ENDPROC
462BDEPROCJMP:PROCP(3,64):ENDPROC
463BDEPROCJM1:PROCP(3,66):ENDPROC
464BDEPROCJM2:PROCP(3,68):ENDPROC
465BDEPROCJM3:PROCP(3,70):ENDPROC
466BDEPROCBT4:PROCP(3,78):ENDPROC
467BDEPROCJR:PROCP(3,72):ENDPROC
468BDEPROCJR1:PROCP(3,76):ENDPROC
469BDEPROCJR2:PROCP(3,80):ENDPROC
470BDEPROCPM:PROCP(3,82):ENDPROC
471BDEPROCPM1:PROCP(3,84):ENDPROC
472BDEPROCPM2:PROCP(3,86):ENDPROC
473BIFFNC(3) ?PX=74:PX?1=LXMOD256:PX?2=LXDIV256:PX?=PX
-3
474BENDPROC
475BDEPROCVD8
476BIFPX(2+LENB8) ?PX=98:PX?1=LENB8:#(PX+2)=B#:PX=PX
+2+LENB8
477BENDPROC
478BDEPROCFI
479BIFPX(2+LENB8) ?PX=92:PX?1=LENB8:#(PX+2)=B#:PX=PX
+2+LENB8
480BENDPROC
481BDEPROCBGR:PROCP(1,102):ENDPROC
482BDEPROCBGN:PROCP(1,104):ENDPROC
483BDEPROCBB:PROCP(1,106):ENDPROC
484BDEPROCBT:PROCP(1,108):ENDPROC
485BDEPROCADV:PROCP(1,110):ENDPROC
486BDEPROCVD:PROCP(1,112):ENDPROC
487BDEPROCVP:PROCP(1,114):ENDPROC
488BDEPROCLA:PROCP(1,116):ENDPROC
489BDEPROCLV:PROCP(1,118):ENDPROC
490BDEPROCVV:PROCP(1,120):ENDPROC
491BDEPROCVR:PROCP(1,122):ENDPROC
492BDEPROCVT:PROCP(1,124):ENDPROC
493BDEPROCAR(PX,AX)
494BIFPX<CE OR PX>2*EX ENDPROC
495BPRT?2=ASD1V256
496BPRT?3=MXMOD256A
497BENDPROC
498B
500BDEPFNC(BX)
501BIFPX>EX ENX=ENX+1:EX=EX-BX:#FALSE ELBE:=TRUE
502BDEPROCERT:PRINT"ERROR";TO CONTINUE ";REPEAT U
NTIL INKEY(-14):PRINT:ENDPROC
503BDEPROCERR:PRINT
504BDEPROCERR
505BIF!X=1 PRINT"missing "
506BIF!X=2 PRINT"no such line number ";B#(BNX)
507BIF!X=3 PRINT"no such fn/proc ";B#(BNX)
508BIF!X=4 PRINT"too many variables"
509BIF!X=5 PRINT"program needs ";MLX;' lines'
510BIF!X=6 PRINT"program needs ";2*MCX+CE-EX;" bytes
"
511BIF!X=7 PRINT"syntax error "
512BIF!X=8 PRINT"array already dim'd"
513BIF!X=9 PRINT"array ";B#(BNX);" not dim'd"
514BENDPROCERR
515BDEPROCIS(BX)
516BIF!X=0 ENDPROC
517BIF!X=2 ENDPROC
518BPRINT"missing ";
519BELSE:IF!X=1:X=0:
520BIFAX1>32 ANDAX<>lino THEN CALL TK ELBEIFAX=id PRIN
T"id / variable";ELBEIFAX=ar PRINT"array dim";ELBEIFA
X=[ PRINT"expression";ELBEIFAX=lino PRINT"line number
";
521BAX=TX:ENDPROC:IFTX=TX:TX=B:PROCERT:ENDPROC
522BIFTX=lexn OR ELX=mop TX=ELX:ELX=FALSE:ENDPROC
523BELSEIFTX=lexn PRINT"EXPECTED";:ELX=FALSE:ENDPROC
524BENDPROC
525BDEPROCIT
527BPRINT"";ENX;' ERRORS - COMPILATION STOPPED"
528BENDPROC
529BDEPRINT "COMPILATION COMPLETE"
530BENDPROC
532BDEPROCT
533BPOP13=BTO33
534BVDU129+(IX/2)MOD5;IX?;141;135
535BPRINT"T.C. BASIC COMPILER >>>"
537BENDPROC
```

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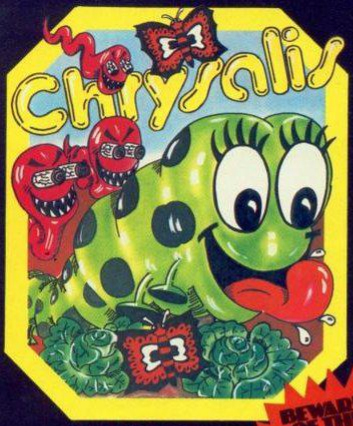

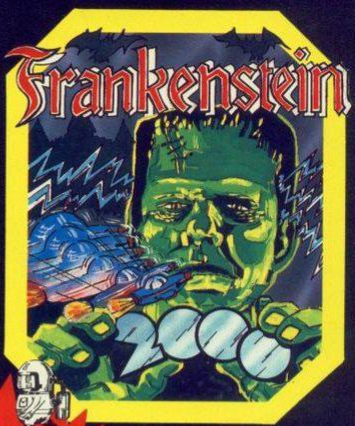

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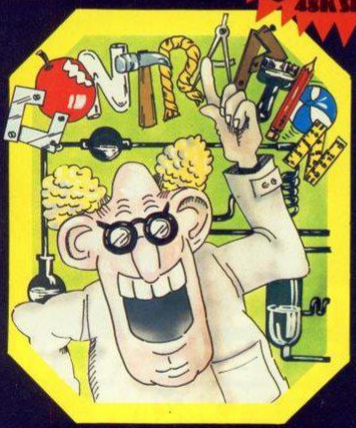

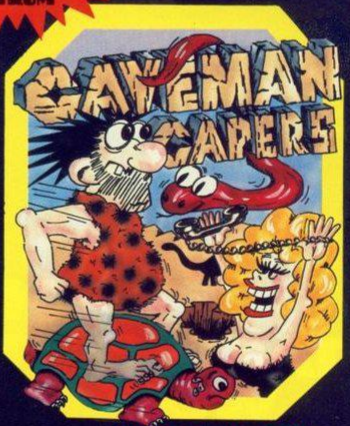

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Hex loader.

```
100 MODE 4
110 BORDER 5,0,6:CLS
120 PRINT"Type in starting address (followed
    by an 'h' if in hex)"
130 INPUT a$
140 IF a$(LEN(a$) TO LEN(a$))="h" THEN
150  a$=a$(1 TO LEN(a$)-1)
160  hex_dec a$
170 ELSE
180  t=a$
190 END IF
200 add=t
210 REPeat loader
220  CLS
230  FOR col=0 TO 18
240   AT col,0
250   dec_hex add,5
260   PRINT d$;"     ";
270   FOR q=0 TO 1
280    dec_hex PEEK(add+q),2
290    PRINT d$;
300   END FOR q
310   AT col,18
320   INPUT"?";b$
330   IF b$="" THEN GO TO 390
340   hex_dec b$
350   POKE_W add,t
360   AT col,18
370   dec_hex t,4
380   UNDER 1:PRINT d$;:UNDER 0:PRINT"   ";
390   add=add+2
400  END FOR col
410 END REPeat loader
420 DEFine PROCedure hex_dec(h$)
430  LOCal l,a$,v
440  v=0:t=0
450  FOR l=0 TO LEN(h$)-1
460   a$=h$(LEN(h$)-l TO LEN(h$)-l)
470   IF CODE(a$)>57 THEN
480    v=CODE(a$)-87
490   ELSE
500    v=a$
510   END IF
520   t=t+v*16^l
530  END FOR l
540 END DEFine
550 DEFine PROCedure dec_hex(v,l)
560  LOCal c,a$,b
570  b=v:d$=""
580  a$=b:a$=a$(1 TO 1)
590  b=ABS(b)
600  REPeat work
610   c=(b/16-INT(b/16))*16
620   IF c<=9 THEN
630    d$=CHR$(c+48)&d$
640   ELSE
650    d$=CHR$(c+55)&d$
660   END IF
670   b=INT(b/16)
680   IF b=0 THEN EXIT work
690  END REPeat work
700  d$=FILL$("0",l-LEN(d$))&d$
710  IF a$="-"THEN d$=a$&d$
720 END DEFine
```

ZOOM

Carsten Greve makes the QL screen bigger.

ZOOM IS a graphics utility for the QL which enlarges part of the screen in Mode 4 or Mode 8. It allows you to double one of the four screen quadrants simply by pressing a key. Once you have zoomed you can zoom again, and again . . . until the screen either fills up or becomes empty.

If you have an assembler you can enter the assembler code directly. You must remember that it has to produce an executive code — that is a position independent code.

If you have not got an assembler you can use the Basic hex-loader listed elsewhere or use your own program to enter the assembled code — this is much faster than using an assembler but errors arise more often.

If you use the Basic hex-loader type the program in and save it for later use. Make room in memory for the machine code by typing

OP = RESPR (512)

See what starting address you have got for the code by typing

PRINT OP

Run the hex-loader and type in the address. Remember that you must type in the code as words, so if the listing says:

0000' 223C 0000 2000 23
MOVE.L #HEAP__ROOM,D1

(continued on page 101)

Explaining Zoom.

8 – 15	QDOS Trap routines.
18-24	Take 8192 bytes from the common heaproom. If not succeeded kill Zoom and return to Superbasic.
26-37	Open a console and set the cursor. If not succeeded kill Zoom and return to Superbasic.
38-44	Find out display mode and store it for later use.
46-62	Get a number from keyboard and jump to an Area.
64-101	Fill Heap__Room with the right area of screen.
103-140	Take Heap__Room and enlarge to the whole screen.
142-146	Kill Zoom and return to Superbasic.
148-182	Data definition for console and Bit__Data.

Assembly listing.

```
 LOC        OBJECT          STMT          SOURCE STATEMENT

                             1 * ZOOM
                             2 * A procedure to enlarge part of the screen
                             3 * By Carsten Greve
                             4 * Started on the 14th of December 1984
                             5 * Finished on the 22nd of December 1984
                             6 * For the SINCLAIR QL version JM
                             7
     =2000                   8 HEAP_ROOM EQU      8192
     =0018                   9 MT_ALCHP  EQU      24
     =0001                  10 IO_OPEN   EQU      1
     =000E                  11 SD_CURE   EQU      14
     =0001                  12 IO_FBYTE  EQU      1
     =00CA                  13 UT_ERRO   EQU      202
     =0005                  14 MT_FRJOB  EQU      5
     =0010                  15 MT_DMODE  EQU      16
                            16
0000'                       17 START
0000'  223C 0000 2000       18          MOVE.L   #HEAP_ROOM,D1
0006'  74FF                 19          MOVEQ    #-1,D2
0008'  7018                 20          MOVEQ    #MT_ALCHP,D0
000A'  4E41                 21          TRAP     #1
000C'  4A80                 22          TST.L    D0
000E'  6600 0158            23          BNE      JOB_END
0012'  2A48                 24          MOVE.L   A0,A5
0014'  72FF                 25
0016'  7602                 26          MOVEQ    #-1,D1
0018'  41FA 015A            27          MOVEQ    #2,D3
001C'  7001                 28          LEA.L    DEVNAME,A0
001E'  4E42                 29          MOVEQ    #IO_OPEN,D0
0020'  4A80                 30          TRAP     #2
0022'  6600 0144            31          TST.L    D0
0026'  76FF                 32          BNE      JOB_END
0028'  700E                 33          MOVEQ    #-1,D3
002A'  4E43                 34          MOVEQ    #SD_CURE,D0
002C'  4A80                 35          TRAP     #3
002E'  6600 0138            36          TST.L    D0
                            37          BNE      JOB_END
0032'  72FF                 38
0034'  74FF                 39          MOVEQ    #-1,D1
0036'  7010                 40          MOVEQ    #-1,D2
0038'  4E41                 41          MOVEQ    #MT_DMODE,D0
003A'  E309                 42          TRAP     #1
003C'  1801                 43          LSL.B    #1,D1
                            44          MOVE.B   D1,D4
003E'  284D                 45
0040'  76FF                 46 LOOP_0   MOVE.L   A5,A4
0042'  7001                 47          MOVEQ    #-1,D3
0044'  4E43                 48          MOVEQ    #IO_FBYTE,D0
0046'  4A80                 49          TRAP     #3
                            50          TST.L    D0
```

(listing continued on page 101)

```
* Program to dump a screen
* Using <ESC>"*"+5+n1+n2
* By Carsten Greve
* Started on the 29th of D

        MOVEQ     #-1,D1
        MOVEQ     #1,D3
        LEA.L     DEVNAM
        MOVEQ     #1,D0
        TRAP      #2
        TST.L     D0
        BNE.S     END_JO

        MOVE.W    #3,D2
        MOVE.W    #-1,D3
        LEA.L     SETUP,
```

```
* Program to
* Using <ESC>
* By Carsten
* Started on

        MOV
        MOV
        LEA
```

```
mp a sc
"+5+n1+
eve
e 29th
```

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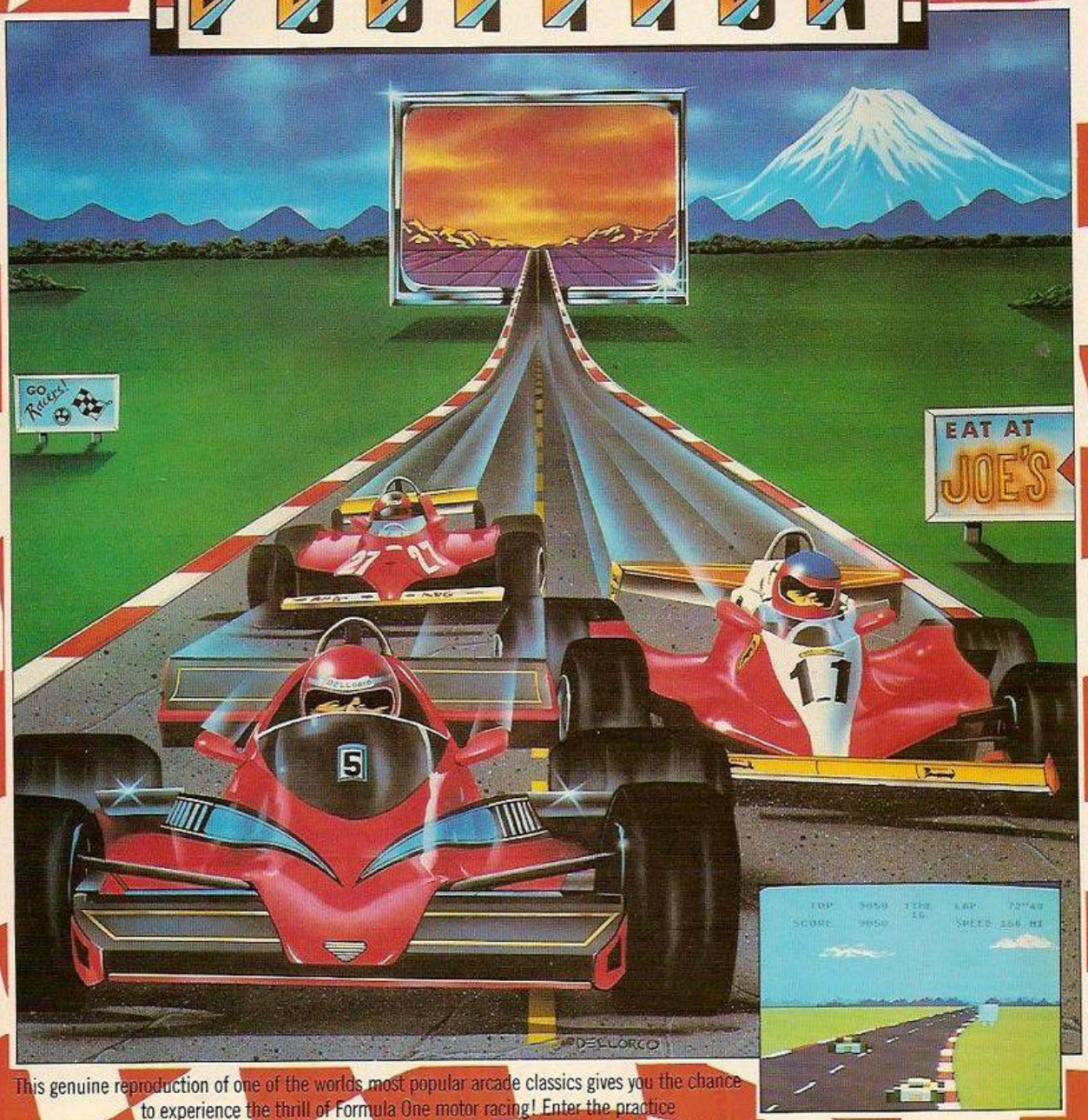

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(listing continued from page 99)

```
0048'  6600 011E          51            BNE       JOB_END
004C'  B23C 0031          52            CMP.B     #$31,D1
0050'  671C               53            BEQ.S     AREA_1
0052'  B23C 0032          54            CMP.B     #$32,D1
0056'  6736               55            BEQ.S     AREA_2
0058'  B23C 0033          56            CMP.B     #$33,D1
005C'  6750               57            BEQ.S     AREA_3
005E'  B23C 0034          58            CMP.B     #$34,D1
0062'  676A               59            BEQ.S     AREA_4
0064'  B23C 000A          60            CMP.B     #$0A,D1
0068'  6700 0104          61            BEQ       END_JOB
006C'  60D0               62            BRA.S     LOOP_0
                          63
006E'  227C 0002 0000     64 AREA_1     MOVE.L    #$20000,A1
0074'  28D9               65 LOOP_1     MOVE.L    (A1)+,(A4)+
0076'  2209               66            MOVE.L    A1,D1
0078'  0801 0006          67            BTST      #6,D1
007C'  67F6               68            BEQ.S     LOOP_1
007E'  D3FC 0000 0040     69            ADDA.L    #$40,A1
0084'  B3FC 0002 4000     70            CMPA.L    #$24000,A1
008A'  66E8               71            BNE.S     LOOP_1
008C'  605E               72            BRA.S     FILL_SCR
                          73
008E'  227C 0002 0040     74 AREA_2     MOVE.L    #$20040,A1
0094'  28D9               75 LOOP_2     MOVE.L    (A1)+,(A4)+
0096'  2209               76            MOVE.L    A1,D1
0098'  0801 0006          77            BTST      #6,D1
009C'  66F6               78            BNE.S     LOOP_2
009E'  D3FC 0000 0040     79            ADDA.L    #$40,A1
00A4'  B3FC 0002 4040     80            CMPA.L    #$24040,A1
00AA'  66E8               81            BNE.S     LOOP_2
00AC'  603E               82            BRA.S     FILL_SCR
                          83
00AE'  227C 0002 4000     84 AREA_3     MOVE.L    #$24000,A1
00B4'  28D9               85 LOOP_3     MOVE.L    (A1)+,(A4)+
00B6'  2209               86            MOVE.L    A1,D1
00B8'  0801 0006          87            BTST      #6,D1
00BC'  67F6               88            BEQ.S     LOOP_3
00BE'  D3FC 0000 0040     89            ADDA.L    #$40,A1
00C4'  B3FC 0002 8000     90            CMPA.L    #$28000,A1
00CA'  66E8               91            BNE.S     LOOP_3
00CC'  601E               92            BRA.S     FILL_SCR
                          93
00CE'  227C 0002 4040     94 AREA_4     MOVE.L    #$24040,A1
00D4'  28D9               95 LOOP_4     MOVE.L    (A1)+,(A4)+
00D6'  2209               96            MOVE.L    A1,D1
00D8'  0801 0006          97            BTST      #6,D1
00DC'  66F6               98            BNE.S     LOOP_4
00DE'  D3FC 0000 0040     99            ADDA.L    #$40,A1
00E4'  B3FC 0002 8040    100            CMPA.L    #$28040,A1
00EA'  66E8              101            BNE.S     LOOP_4
                         102
00EC'  284D              103 FILL_SCR   MOVE.L    A5,A4
00EE'  227C 0002 0000    104            MOVEA.L   #$20000,A1
00F4'  1214              105 LOOP_FS    MOVE.B    (A4),D1
00F6'  E809              106            LSR.B     #4,D1
00F8'  C27C 000F         107            AND.W     #$F,D1
00FC'  D204              108            ADD.B     D4,D1
00FE'  45FA 007A         109            LEA.L     BIT_DATA,A2
0102'  1432 1000         110            MOVE.B    0(A2,D1.W),D2
0106'  1342 0080         111            MOVE.B    D2,$80(A1)
010A'  12C2              112            MOVE.B    D2,(A1)+
010C'  121C              113            MOVE.B    (A4)+,D1
010E'  C27C 000F         114            AND.W     #$F,D1
0112'  D204              115            ADD.B     D4,D1
0114'  1432 1000         116            MOVE.B    0(A2,D1.W),D2
0118'  1342 0081         117            MOVE.B    D2,$81(A1)
011C'  1342 0001         118            MOVE.B    D2,1(A1)
0120'  1214              119            MOVE.B    (A4),D1
0122'  E809              120            LSR.B     #4,D1
0124'  C27C 000F         121            AND.W     #$F,D1
0128'  D204              122            ADD.B     D4,D1
012A'  45FA 004E         123            LEA.L     BIT_DATA,A2
012E'  1432 1000         124            MOVE.B    0(A2,D1.W),D2
0132'  1342 0080         125            MOVE.B    D2,$80(A1)
0136'  1282              126            MOVE.B    D2,(A1)
0138'  121C              127            MOVE.B    (A4)+,D1
013A'  C27C 000F         128            AND.W     #$F,D1
013E'  D204              129            ADD.B     D4,D1
0140'  1432 1000         130            MOVE.B    0(A2,D1.W),D2
0144'  1342 0082         131            MOVE.B    D2,$82(A1)
0148'  1342 0002         132            MOVE.B    D2,2(A1)
014C'  5689              133            ADDQ.L    #3,A1
014E'  3209              134            MOVE.W    A1,D1
0150'  0801 0007         135            BTST      #7,D1
0154'  679E              136            BEQ.S     LOOP_FS
0156'  D3FC 0000 0080    137            ADDA.L    #$80,A1
015C'  B3FC 0002 8000    138            CMPA.L    #$28000,A1
0162'  6690              139            BNE.S     LOOP_FS
0164'  6000 FED8         140            BRA       LOOP_0
                         141
0168'  3478 00CA         142 JOB_END    MOVE.W    UT_ERR0,A2
016C'  4E92              143            JSR       (A2)
016E'  7005              144 END_JOB    MOVEQ     #MT_FRJOB,D0
0170'  72FF              145            MOVEQ     #-1,D1
0172'  4E41              146            TRAP      #1
                         147
0174'  0004              148 DEVNAME    DC.W      4
0176'  434F 4E5F         149            DC.B      'CON_'
                         150          These are for MODE 4
017A'  00                151 BIT_DATA   DC.B      %00000000
017B'  03                152            DC.B      %00000011
017C'  0C                153            DC.B      %00001100
017D'  0F                154            DC.B      %00001111
017E'  30                155            DC.B      %00110000
017F'  33                156            DC.B      %00110011
0180'  3C                157            DC.B      %00111100
0181'  3F                158            DC.B      %00111111
0182'  C0                159            DC.B      %11000000
0183'  C3                160            DC.B      %11000011
0184'  CC                161            DC.B      %11001100
0185'  CF                162            DC.B      %11001111
0186'  F0                163            DC.B      %11110000
0187'  F3                164            DC.B      %11110011
0188'  FC                165            DC.B      %11111100
                                      These are for MODE 8
0189'  FF                166            DC.B      %11111111
018A'  00                167            DC.B      %00000000
018B'  05                168            DC.B      %00000101
018C'  0A                169            DC.B      %00001010
018D'  0F                170            DC.B      %00001111
018E'  50                171            DC.B      %01010000
018F'  55                172            DC.B      %01010101
0190'  5A                173            DC.B      %01011010
0191'  5F                174            DC.B      %01011111
0192'  A0                175            DC.B      %10100000
0193'  A5                176            DC.B      %10100101
0194'  AA                177            DC.B      %10101010
0195'  AF                178            DC.B      %10101111
0196'  F0                179            DC.B      %11110000
0197'  F5                180            DC.B      %11110101
0198'  FA                181            DC.B      %11111010
0199'  FF                182            DC.B      %11111111
                         183
                         184            END
```

(continued from page 99)

you must type 223C and Enter, 0000 and Enter, 2000 and Enter.

If the listing says:

```
0190' 5A 173 DC.B %01011010
0191' 5F 174 DC.B %01011111
```

you must type 5A5F and Enter.

When you have finished typing in press Ctrl-space. To check the code you must Run the hex-loader again with the same starting address. If the code is correct just type Enter, and if the code is incorrect type the correct code in and continue.

If you have used an assembler, the assembler should have produced an Executable code. If you have used the hex-loader you must type:

SEXEC mdv1_ZOOM,OP,412,64

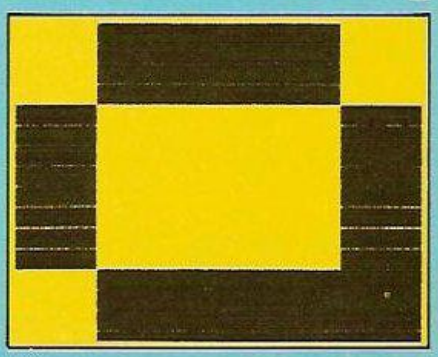
Therre are two different ways of running the Zoom-code and I will describe both here.

EXEC_W MDV1_ZOOM = With this command you run the code and you cn make as many Zoom's as you like, and when you have finished you type Enter to return to Superbasic.

EXECMDV1_ZOOM = With this command you also run the code, but you stay in Superbasic. To make a Zoom you must type Ctrl C to transfer control to the Zoom-procedure. Now you can again make as many Zoom's as you like, but to go back to Superbasic you just have to type Ctrl C. In this way you can use the Zoom-procedure on many screens.

The screen is organised in the following way and you just have to type one of the numbers to obtain a Zooming.

1	2
3	4



PLOTLINE

Mark Jones with a set of programs which show how difficult it is to manipulate screen memory and the ease of using the Call command.

THE FOLLOWING machine-code routines for the QL were written as an exercise in 68008 programming. They demonstrate the difficulties involved in manipulating the screen memory and also show the ease with which data can be passed to machine code from Basic using the Call command.

To set up the code, run the Basic code creator program. Whenever you reset the computer you will need to reserve some memory for the routines by typing

BOX = RESPR (250)

Now load the code with

LBYTES MDV1—CODE,BOX

The variable Box contains the address at which the code is stored. To plot a point Call ST, x co-ordinate, y co-ordinate, colour. To draw a box Call ST+2, x co-ordinate of bottom left corner, y co-ordinate of bottom left corner, width of box, depth, thickness of box.

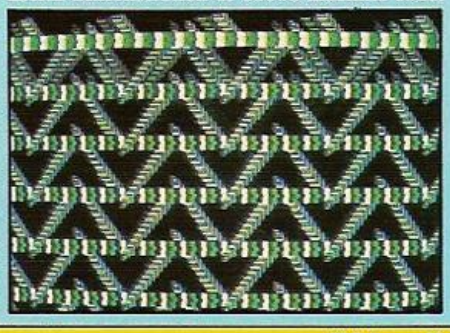
For example, to draw a box at 100,000, width = 10, depth = 10, thickness 3, colour red — in mode 4:

CALL BOX + 2, 100,100,2,10,10,3

For further information see under Call in the QL manual.

The x and y co-ordinates are independent of channels and scale where x = 0, y = 0 is the top left corner of the screen, x = 512 (26 if mode 8), y = 256 is the bottom right corner. Colour codes for the routine are explained in the assembler listing.

Speeds achieved for the plot routine are faster than the QL's own plot routine and this speed advantage is particularly effective in machine code. Using a plot routine is not the fastest way to draw a box but again serves as a useful demonstration of 68008 machine code.



Demo program.

```
1 REMark **** BASIC DEMONSTRATION PROGRAM ****
3 OPEN #4,scr_512x256a0x0:CLS #4
4 FOR h=0 TO 250 STEP 40
5  g=1:j=1
9 FOR m=1 TO 11
10 FOR f=1 TO 50
11 k=f:IF g|k=4k
20 CALL box+2,j,k+h,f,10-f/10,10-f/10,1
21 j=j+1
30 NEXT f
40 g=1-g
50 NEXT m
60 FOR f=1 TO 512 STEP 5:CALL box+2,f,h,f,10,10,4
70 NEXT h
80 FOR f=1 TO 32:PAN #4,16
90 GO TO 4
100 box=RESPR(240):LBYTES mdv1_code#,box:RUN
999 MODE 4:PRINT "Loading Basic Demonstration"
1000 MERGE mdv1_basic_demo:GO TO 100
```

Code loader.

```
1 st=RESPR(500)
2 REMark
10 DATA 96,22,85,10,101,236,62,65,255,4,81,4,97,250,82
,207,72,2,100,134,0,41,183,255,0,65,0,3,0,34,104,76,22
7,68,0,3,239,2,2,196,96,14,255,0,203,41,0
15 REMark
20 DATA 76,82,68,85,4,78,4,97,250,83,207,96,18,62,66,2
55,167,2,66,54,2,0,34,104,100,0,254,28,1,2,65,2,73,0,1
5,0,74,0,68,112,6,227,248,135,41,0,126
25 REMark
30 DATA 96,65,103,69,81,117,96,42,62,66,255,4,81,5,97,
250,126,66,102,1,128,0,2,65,228,7,2,3,226,65,102,65,82
,252,28,3,34,0,1,7,227,29,203,41,0,1,112
35 REMark
40 DATA 10,83,12,183,206,66,4,81,5,97,250,83,207,96,6,
78,0,0,0,34,52,0,65,182,76,58,3,2,14,0,74,0,65,198,3,2
28,124,218,254,144,11,81,41,0,1,76,0
45 REMark
50 DATA 97,66,181,6,255,135,82,207,96,38,62,65,255,4,0
1,117,60,255,0,124,12,0,1,0,2,60,0,3,96,255,226,3,26,6
0,2,14,0,194,218,1,227,200,0,0,141,159,78
51 DATA 117
55 REMark
70 RESTORE
80 tot=0
90 FOR g=0 TO 4
100 FOR f=0 TO 46
110 READ d:POKE st+g+f*5,d
115 tot=tot+d
120 NEXT f
130 NEXT g
140 READ d:POKE st+235,d
145 tot=tot+d
146 IF tot<>18982 THEN PRINT "error"
147 PRINT "code stored ok from ";st;" length 236 bytes
"
150 STOP
```

Assembly listing.

```
MODE     EQU    163892
SCREEN   EQU    131072
*
*
PLIN  BRA.S  PLOT      ENTER HERE FROM BASIC TO PLOT ONLY
BXIN  BRA.S  MULTI     ENTER HERE FROM BASIC TO DRAW BOX (PLIN +2)
*****************************************************************************
*  MULTI THICNESS BOX ROUTINE                                               *
*      D6=THICKNESS OF BOX, WIDTH AND DEPTH ARE EXTERNAL MEASUREMENTS       *
*      OTHER ENTRY PARAMETERS AS FOR BOX ROUTINE                            *
*                                                                           *
*****************************************************************************
LOOP  BSR.S      BOX
      ADDQ       #1,D1          NEXT BOX LH CORNER IS X=X+1
      SUBQ       #1,D2          Y=Y-1
      SUBQ       #2,D4          WIDTH=WIDTH-2
      BEQ.S      EXIT           EXIT LOOP IF WIDTH=0
      BCS.S      EXIT           EXIT LOOP IF WIDTH<0
      SUBQ       #2,D5          DEPTH=DEPTH-2
      BEQ.S      EXIT           EXIT LOOP IF DEPTH=0
      BCS.S      EXIT           EXIT LOOP IF DEPTH<0
MULTI DBRA       D6,LOOP        DRAW (D6) BOXES. ENTER ROUTINE HERE FROM BOX_ENT
EXIT  RTS
*****************************************************************************
*   BOX ROUTINE          D1=X, D2=Y, D3=COL, D4=WIDTH, D5=DEPTH              *
*                                                                           *
*          ALL REGISTERS UNCHANGED EXCEPT   A1=ADDRESS OF LH CORNER, D7=-1  *
*                                                                           *
* MODE 4 COLS  0=BLACK,1=GREEN,2=RED,3=WHITE                                *
* MODE 8 COLS  0=BLACK,2=GREEN,4=BLUE,6=CYAN,8=RED,10=YELLOW,12=MAGENTA     *
*              14=WHITE,ADD 1 TO MODE 0 COLOUR FOR FLASH                    *
*****************************************************************************
BOX   CLR.L      D7
      MOVE.W     D4,D7
      BRA.S      BOXA           TOP OF BOX
BOXAA ADDQ       #1,D1
      BSR.S      PLOT
BOXA  DBRA       D7,BOXAA
*
      MOVE.W     D5,D7
      BRA.S      BOXB
BOXBB SUBQ       #1,D2          RIGHTHAND SIDE
      BSR.S      PLOT
BOXB  DBRA       D7,BOXBB
*
      MOVE.W     D4,D7
      BRA.S      BOXC
BOXCC SUBQ       #1,D1          BOTTOM OF BOX
      BSR.S      PLOT
BOXC  DBRA       D7,BOXCC
*
      MOVE.W     D5,D7
      BRA.S      BOXD
BOXDD ADDQ       #1,D2          LEFTHAND SIDE
      BSR.S      PLOT
BOXD  DBRA       D7,BOXDD       X1 AND X2 ARE NOW BACK TO ORIGINAL VALUES
      RTS
*****************************************************************************
* PLOT ROUTINE   D1=X D2=Y D3=COLOUR(0-15)                                  *
*                SPEED=110 PLOTS/SEC FROM BASIC - 3000 PLOTS/SEC FROM M/C   *
*                      QL POINT ROUTINE=40 PLOTS/SEC                        *
*        ALL REGISTERS UNCHANGED EXCEPT D0-D,A1(LEFT WITH SCREEN ADDRESS)   *
*                                                                           *
*****************************************************************************
PLOT  MOVEM.W    D1-D6,-(A7)          SAVE REGISTERS
      MOVE.W     D2,D6                COPY Y
      ANDI.W     #255,D2
      CMP.W      D2,D6                Y OUT OF RANGE ?
      BNE        RANGX
      MOVE.W     D1,D4                COPY X
      MOVE.L     #MODE,A1             MODE STORAGE AREA
      CMPI.B     #8,0(A1)             MODE 8 ?
      BEQ.S      MODE8                YES..
*
*        EITHER MODE 8 OR MODE 4 ROUTINE USED HERE
*
MODE4 ANDI.W     #511,D1              0<X<512
      CMP.W      D1,D4                X OUT OF RANGE ?
      BNE        RANGX
      LSR.W      #2,D4                X2=X/4          USED FOR ADDRESS
      ANDI.W     #7,D1                X AND 7     * X3=X AND 7
      MOVE.W     #254,D5              MASK=11111110
      ANDI.B     #3,D3                COLOURS 0-3
      MOVE.B     D3,D6                COPY COLOUR
      ANDI.B     #1,D3                BOTTOM 1 BIT OF COLOUR BYTE 1
      LSR.B      #1,D6                TOP 1 BIT OF COLOUR BYTE 2
      BRA.S      ALLOK
*
*
*
MODE8 ANDI.W     #255,D1              0<X<256
      CMP.W      D1,D4                X OUT OF RANGE ?
      BNE.S      RANGX
      LSR.W      #1,D4                X2=X/2          USED FOR ADDRESS
      ANDI.W     #3,D1                X AND 3     *
      LSL.W      #1,D1                X*2         * X3=2*(X AND 3)+1
      ADDQ       #1,D1                X+1         *
      MOVE.B     #252,D5              MASK=11111100
      AND.B      #15,D3               COLOURS 0-15
      MOVE.B     D3,D6                COPY COLOUR
      ANDI.B     #3,D3                BOTTOM 2 BITS OF COLOUR BYTE1
      LSR.B      #2,D6                TOP 2 BITS OF COLOUR BYTE2
*
*        SCREEN ADDRESS= Y*128 + (IF MODE8 X/4 AND 510,IF MODE4 X/2 AND 510)
*        MODE 4 AND MODE 8 ROUTINES BOTH END UP HERE
*
ALLOK LSL.W      #7,D2                Y2=Y*128
      MOVE.L     #SCREEN,A1           GET START OF SCREEN
      ADDA.W     D2,A1                ADDR=ADDR+Y2
      ANDI.W     #510,D4              LOSE ANY ODD 1
      ADDA.W     D4,A1                ADDR=ADDR+X2
*
*        A1 NOW CONTAINS CORRECT SCREEN ADDRESS
*
      MOVEQ      #7,D0
      SUB.B      D1,D0                7-X3     FIND WHICH BITS TO ALTER
      BRA.S      LPA
LPA1  LSL.B      #1,D3                ROTATE 1ST COLOUR BYTE
      LSL.B      #1,D6                ROTATE 2ND COLOUR BYTE
      ROL.B      #1,D5                ROTATE MASK OVER  E.G 11110011
LPA   DBRA       D0,LPA1
*
*        ACTUAL PLOT IS DONE HERE
*
      AND.B      D5,0(A1)             MASK OF SCREEN  (SET PLOT POS TO 00)
      OR.B       D3,0(A1)             OR 1ST BYTE WITH SCREEN
      AND.B      D5,1(A1)             MASK OF SCREEN
      OR.B       D6,1(A1)             OR 2ND BYTE WITH SCREEN
RANGX MOVEM.W    (A7)+,D1-D6          RETRIEVE REGISTERS
      MOVEQ      #0,D0                ENSURE NO ERROR ON RETURN TO BASIC
      RTS
      END
```

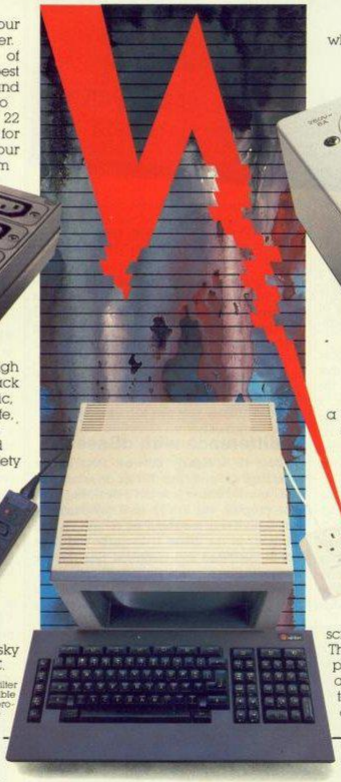
CONNECT PROTECT

Peripherals make using your computer more interesting and easier. But you may have more items of equipment than power outlets. The best way of tidying up the trailing wires and obtaining a 'clean' power supply is to use STRIPBLOC. It has five CEE 22 outlets, probably more than enough for connecting your add-ons to your power source. It's rugged, made from tough black plastic, and safe, meeting British and European safety requirements.

The Stripbloc is RFI filtered against spikes, 'dirty' mains and 'unclean' power.

Once you've bought it you don't need any extras, it's supplied with five standard right-angled rewireable plugs, a 2m fully-approved cable and moulded 13A plug. Forget about risky connections. Be safe with STRIPBLOC.

Stripbloc includes: ■ 1 five outlet mains unit with RFT filter ■ 2m cable with moulded 13A mains plug ■ 5 rewireable right-angled plugs **Spikebloc includes:** ■ 1 mains protection unit with integral 13A mains socket ■ 2m cable with moulded 13A plug



Have you ever noticed interference when you are using your computer?

It could be caused by any number of things: a light switch, a fridge, a central heating motor starting, or even a thunderstorm. The power lines of your computer can pick up many forms of natural and man-made interference, which can be damaging to computers and peripherals. Rendar's SPIKEBLOC has been developed to give protection against transient over voltages and continuous high frequency interference on the mains supply. The unit is housed in a rugged metal case and gives good electrical screening from high frequency sources. This high level of protection was only possible previously using elaborate and expensive filter units. Now it isn't too expensive for you to protect your equipment.

Send to (no stamp required):
Rendar Limited, FREEPOST,
Durban Road, Bognor Regis PO22 9RL.

Please send me the following items:

Item	Quantity	Price	Total
Stripbloc		£24.99	
Spikebloc		£49.99	
		TOTAL	

Name _____
Address _____
_____ Post Code _____

I enclose cheque/postal order made payable to **Rendar Ltd.,**
for £ _____ or debit my
Access/ Visa Credit Card
Access BARCLAYCARD VISA
No _____
(Prices includes VAT, Postage & Packing)

Rendar Ltd, Durban Road, RENDAR Bognor Regis, PO22 9RL.

DATA

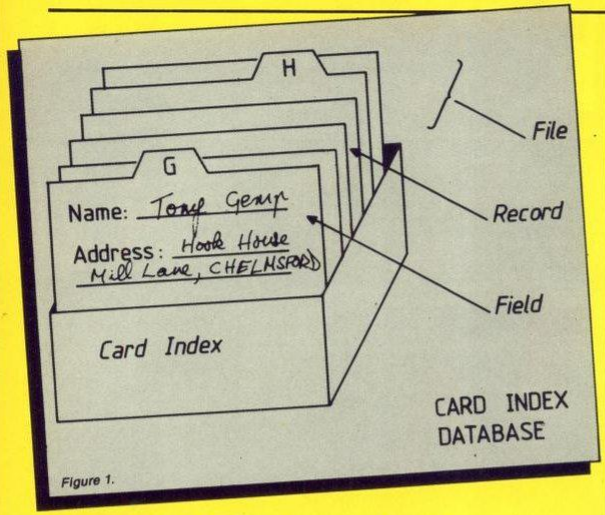


Figure 1.

THIS SERIES of articles is about four database programs for the BBC microcomputer. It is impossible to review these sophisticated programs adequately in a single article and I hope that some of the ideas and the solutions to problems will help you if you are thinking of buying a database program for *any* microcomputer, not just the BBC machine.

A microcomputer is a general-purpose machine that can be made to look like any other machine by programming it to simulate the actions of the machine. In other words, a microcomputer can simulate a numerically controlled machine tool, model a central heating system or act as a central heating system controller, edit and format text or work as a complex pocket calculator.

A microcomputer can be used to store, manipulate and retrieve information and a spreadsheet program like Viewsheet or Ultracalc 2, for example, establishes a sort of database except that it is dedicated to displaying information in a particular way. General-purpose programs for database manipulation make fewer assumptions about the type of data that will be held in the system and the ways in which it will be used for calculation and displayed.

The best known, and most widely sold, database for microcomputers is dBase II which is marketed by Ashton Tate, California. dBase II is written in machine code for the Z-80 central processor unit and will not run directly on the BBC microcomputer's 6502 CPU. However, the program has been installed on the Z-80 second processor for the BBC machine and is now available.

A difference with dBase II

dBase II is entirely different from all the other database programs that are on sale for the BBC micro because it is not a dedicated database program but a high level programming language. There are about 84 commands and functions in the dBase II language and these can be combined into command files that are interpreted by the central dBase II core.

A dBase II program can set up a database of information and can then sort, search, calculate results and output the results in a huge variety of different ways.

The four databases that are included are:

Datagem	Gemini Marketing Ltd., Exmouth. 0395 265165.
Scribe Database	Merlin Computer Products, Swansea. 0792 467980.
Stardatabase	GCC (Cambridge) Ltd., Cambridge. 0223 835330.
Database	Acornsoft Ltd., Cambridge. 0223 316039.

All of these programs are dedicated in the sense that the structure of the information in the database is largely preordained. That seems to contradict some of the advertising claims made for Datagem and Stardatabase so let's see what's going on in more detail.

Figure 1 shows the card index architecture that is used by all four programs. A single file of information is held on a floppy disc and this can be accessed by the program to give you the results that you want. In these programs a *file* looks like a box holding a number of cards. You may have a number of boxes holding cards on different subjects; a stamp collection, a name and address list, recipes for your kitchen and so on.

Each file consists of a number of *records* which you can think of as the individual cards in the card-index box. Each card has information written on it. If the information is organised in a regular way then each piece of information is a *field* in the record.

So, there are several fields in each record and a number of records make up a file. Figure 2 shows the record format for a hypothetical wine cellar file. There are eight fields in each record and the information recorded about each wine is of various types. The date the wine was brought into the cellar is structured information in the form DD/MM/YYYY — Day/Month/Year — while the name of the wine is a string of alphanumeric characters of indeterminate length.

Note particularly that the tasting notes field is longer than the width of the paper or the VDU screen; long fields create special problems for printing out information in three of the databases when you try to use them in conjunction with *View* or *Wordwise*.

Figure 3 shows the record format of a real name and address file. This record layout and the fields it contains are more complex than the usual, trivial examples shown in the instruction manuals because "real" life is both complex and messy.

However, in both figure 2 and figure 3 you can see at once that the same information is recorded in the same place on each card. In other words, the program can look in the same place on each record and expect to find a name, or the date you bought a stamp, or how much you paid for a consignment of wine, or simply the town in which someone lives.

Figure 2.

NAME: Corton-Charlemagne

MERCHANT: S H Jones
TELEPHONE: 0295 11798

VINTAGE: 1980

DATE BOUGHT: 25/05/1983

QUANTITY: 8 bottles
CURRENT STOCK: 3

TASTING NOTES: .....

BASES

In the first in a series of articles, John Dawson looks at databases in general and how they operate.

Figure 3.

PEOPLE 04/03/1985

FILE	LENGTH	625 records
FILE	USED	34 records
RECORD	LENGTH	601 characters

*** FIELD NAME LIST ***

ONAME	S
ACTIVE	S
ADD1	S
ADD2	S
ADD3	S
CODE	S
FAMILY	S
FNAME	S
KEY1	S
NOTES	S
ORGN	S
P1	S
P2	S
P3	S
P4	S
PINDEX	S
TITLE	S
UPDATE	N
XMAS	S
XREF	S
XREF1	S

*** INPUT CARD ***

SURNAME.....

Firstname..... Title.....

ORGANISATION.....

TELEPHONE

.....

.....

ADDRESS.....

.....

.....

KEYWORDS.....

.....

.....

A>..... Update..... Christmas.....

Phone Index..... Family.....

References.....

NOTES.....

.....

.....

.....

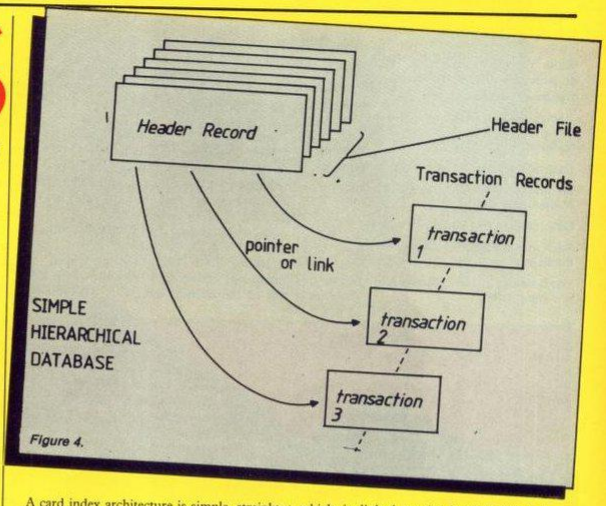


Figure 4.

A card index architecture is simple, straightforward and can be very useful for many purposes. For example, all other factors being equal, you could use any of the four programs for the following purposes:

Software catalogue
Photograph and slide indexing
Christmas card lists
Name and address files
Mailshot personalised mailings
Price lists
Estate agents' housing lists

There are, however, other ways of structuring information that are better suited to many common tasks that you may want to carry out.

Figure 4 illustrates the architecture of a very simple hierarchical database. Suppose that you want to set up an invoicing system for sales of mugs, plates, casserole dishes, parsley pots and other items from your craft pottery. If none of your customers ever buys from you more than once then the card index architecture is quite adequate.

Presumably, though, you would like some of your customers to come back again for more of your goods. When this happens you have to re-enter all the same details about the customer's name, invoice address, delivery address, telephone number each time you make a sale.

Apart from being very time consuming, the chances of errors occurring are large and if you make a mistake in entering the customer's name it becomes more and more difficult to relate one sale in June to another in October and two in the previous March. You can't run any sort of a credit system with the card index approach.

The database in figure 4 is different. When a customer first makes contact with your operation the name, addresses, telephone numbers and other information that you will need for the first, *and subsequent orders,* are typed into the database to form a header record. The goods that you supply, the cost per item, total price, Value Added Tax, discount and so on are entered into a separate transaction record which is linked to the header record by a pointer.

The information in the transaction record is different to that in the header record — the second field, for example, may contain a telephone number in the header record and a description of a piece of furniture in the transaction record; so you need two files, but the files are linked automatically by the database program.

When the customer, impressed by your efficiency, returns for the third time you can search through the header file to find the original entry and immediately enter information into a new transaction record for the next sale. In a well designed system it should be possible to merge information from the header record with the transaction record to print an invoice and label for the envelope. The transaction should point to the header, just as the header must point to all the transactions.

dBase II has an exceptionally advanced feature that permits you to work in two separate active areas at the same time: Primary and Secondary. You can switch between the two areas by typing Select Secondary followed by Use 'newfilename'. Return to the primary database is achieved by typing Select Primary.

Prefix the name of variable

Information can be transferred from one area to another by prefixing the name of a variable with either P. or S. This facility means that records in a second file can be found or manipulated by reference to records in the first file.

dBase II is an example of the third type of database which has been talked about greatly in the last few years. dBase II is a relational database. E.F. Codd published a fundamental paper titled 'A Relational Model of Data for Large Shared Databanks' in Communications ACM in June 1970.

Although the theory of relational databases

(continued on next page)

(continued from previous page)
can be taken into quite high powered mathematics, the ideas underlying it all are simply to do with tables. As Kenneth Robinson says in Database Analysis and Design:

"tables are a very simple and natural way of regarding data . . . The tables conform to a set of rules . . .

Each box in a table contains one value

Within a column the box values are all of the same kind

Each column has a distinct name

Each row is unique — there are no duplicates

The ordering of the columns and rows is not significant"

Figure 5 illustrates part of a simple medical relational database. The information in the database is arranged in tables and each part of the information relates to other parts. The patient's name is put together with the address and a registration number.

By looking down — searching — the name and address file it's possible to find a name by reference to the registration number or the number in relation to a name. Similarly, the drug stock list file contains information about the cost of each drug and the quantity that should be held in stock.

The prescriptions file relates to both the patients and drugs file. A patient called M Hunter (No. 4914) was prescribed one Salbutamol inhaler on 5 November 1983. The cost of the inhaler was £4.75. The relations between data in the tables could be much more complex.

For example, you may want to see the total cost of prescriptions which have been issued for Penicillin in the last year and to whom they were given — children are not charged. The prescriptions table must be searched for Penicillin between 1 January 1984 and 31 December 1984 and the registration numbers looked up. The age of the patient must be extracted from the patient file and the quantity prescribed costed for records matching the age criteria.

Next month I'll describe the four programs in detail, look at passwords, record and file sizes, and discuss how you can set about planning and building a database for your own purposes. ■

RELATIONAL DATABASE

Patients

name	address	no.
HUNTER. J	25 MILL ROAD	4250
HUNTER. M	25 MILL ROAD	4914
JAMES. A	135 WHEELER ST	1772
KYLE. J	2 NEW CROSS ST	5918
MARKS. B	101 RUTLAND RD.	6664
WEBB. E	4 UPPER LANE	3350
WEBB. F	271 WARWICK ST	2218
DAWSON. R	11 ABBEY CLOSE	7253

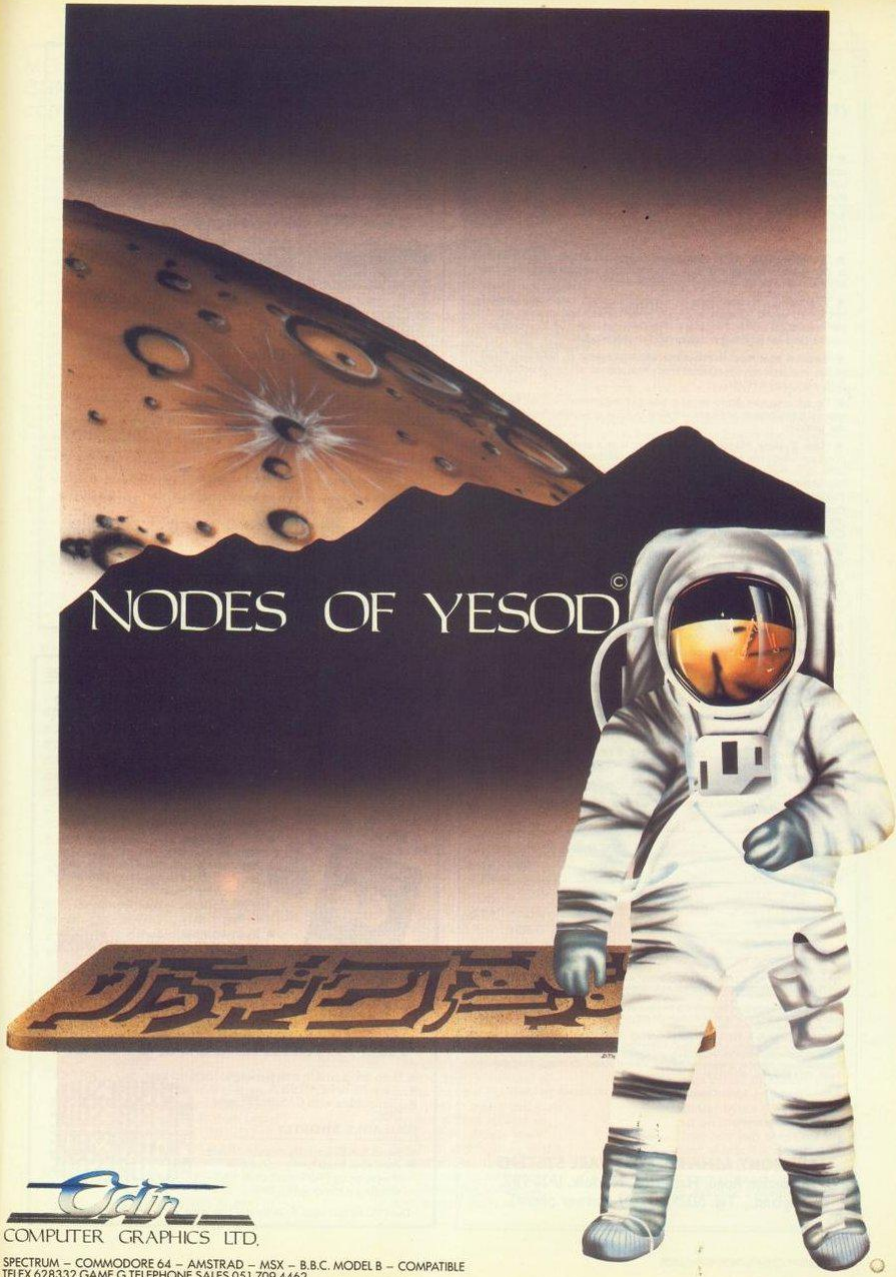
Drug Stocks

drug	stock	cost
SALBUTAMOL	10 INHALERS	4.75
PENICILLIN	1000 TABS	10.70
AMPICILLIN	1000 TABS	25.35
TETRACYCLINE	500 TABS	17.50
NITRAZEPAM	1000 TABS	19.10
OXAZEPAM	1500 TABS	27.80
PHENERGAN	400 TABS	11.15
WARFARIN	1200 TABS	35.60
ASPIRIN	2000 TABS	4.35

Prescriptions

no.	date	drug	dose
4914	5/11/83	SALBUTAMOL	2 × 3(1)
3149	5/11/83	PENICILLIN	2 × 4(48)
1772	5/11/83	WARFARIN	1 × 4(20)
5918	6/11/83	PENICILLIN	2 × 4(48)
6664	6/11/83	NITRAZEPAM	2 × 1(30)
3149	10/11/83	PHENERGAN	1 ADV(20)

Figure 5.



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AMSTRAD CPC (mono or colour) (Cassette: £15.00 + VAT).
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COMMODORE 64 (Cassette: £15.00 + VAT).
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or,
Software Limited, No. 2 Alice Owen Technology Centre, 251 Goswell Road, London, EC1. Tel. (01-833) 1173.

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DPOKE double poke
EDIT specified line
ELSE (used with IF...THEN)
EXIT leave DO-LOOP
FILL enclosed area with specified ink or paper
GET wait for keypress
JOIN two program lines
KEY$ a string
LIST specific new keywords on/off
LISTALIST line TO line
USED (used with GOTO, GOSUB)
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USING used with PRINT
WHILE used with DO or LOOP
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XRG, YRG change PLOT scale

FUNCTIONS

AND (bit-by-bit)
BIN$ decimal to binary
CHAR$ number to 2 characters
CODE fast codeno
DEC hexadecimal to decimal
DPEEK double PEEK
FILLED filled area
HEX$ decimal to hexadecimal
INSTR$0 string search
MEM free memory
MEMORY$ all of memory as a string
MOD modulus
NUMBER 2 characters to number
OR (bit-by-bit)
RND# fast RND
SCRN$ recognises user graphics
SINE fast sine
STRING$ repeats strings
TIME$ current time
USING$ formats numbers
XOR (bit-by-bit)

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MC Hart gives your CBM-64 an extra command.

REPEAT UNTIL

```
1 REM **** REPEAT-UNTIL ****
2 REM          C-64
3 :
4 REM  ***  M. C. HART  ***
5 :
6 REM SYNTAX:&R:(EXP),...,&U:(EXP)
7 :
8 FOR J=828 TO 968:READ X:POKE J,X:NEXT:END
9 :
10 DATA 201,58,176,234,76,95,3,162
11 DATA 2,189,64,3,149,124,202,16
12 DATA 248,232,134,2,96,76,171,227
13 DATA 162,2,189,68,3,149,124,202
14 DATA 16,248,96,201,38,208,238,32
15 DATA 115,0,201,85,240,37,201,82
16 DATA 208,227,165,2,10,10,170,165
17 DATA 123,157,167,2,165,122,157,168
18 DATA 2,165,58,157,169,2,165,57
19 DATA 157,170,2,230,2,32,115,0
20 DATA 76,174,167,32,115,0,32,115
21 DATA 0,32,158,173,165,87,240,5
22 DATA 198,2,76,64,169,168,2,202
23 DATA 138,10,10,170,189,167,2,133
24 DATA 123,189,168,2,133,122,189,169
25 DATA 2,133,58,189,170,2,133,57
26 DATA 104,104,76,228,167
27 :
28 :
100 REM *** DEMO REPEAT-UNTIL ***
110 :
120 SYS 835 :REM INITIALISE
130 :
140 &R:A=A+1:PRINT"OUTER";A:REM OUTER
150 :
160 J=0 :REM NO ZERO BEFORE INNER LOOP
170 :
180 ::&R:J=J+1:PRINT J,:REM INNER
190 ::&U:J=4:PRINT:REM INNER
200 :
210 &U:A=10:REM OUTER
220 :
230 PRINT"--END--"
240 :
250 SYS 852 :REM RESTORE CHRGOT
READY.
```

THOSE WHO like structured programming or even those who are just interested in 6502/6510 programming for its own sake might be interested in this Repeat-Until.

The routine works by altering Chrgot to look for and process the & symbol followed by R — for Repeat — or U — for Until. Other characters will be passed to the interpreter where they will generate a syntax error.

Unlike For-Next loops in CBM Basic a variable which is used within a loop — such as J in the inner loop in the demo provided — is not initialised back to a starting value and it is the responsibility of the programmer to ensure that such variables are set to the correct value before the loop is entered.

Notice also that the loop will always execute at least once: if a Do-While loop is required which may require the entire loop being skipped if the initial conditions are met then this is best tested for before the Repeat-Until loop is entered. When the routine is in operation, the interpreter will not handle spaces — outside quotes — in excess of one — hence the double colons in lines 180-190.

When Run the code will be read into the cassette buffer — if you totalise the X's in line 8 then they should provide you with a checksum of 15167. The routine is activated by a Sys 835 and restored to normal by a Sys 852. Run 100 runs the little demo routine.

Disassembly.

```
B*
   PC   SR AC XR YR SP
.;0008 30 4F 4F 00 F6
.
033C C9 3A        CMP #$3A
033E B0 EA        BCS $032A
0340 4C 5F 03     JMP $035F
0343 A2 02        LDX #$02
0345 BD 40 03     LDA $0340,X
0348 95 7C        STA $7C,X
034A CA           DEX
034B 10 F8        BPL $0345
034D E8           INX
034E 86 02        STX $02
0350 60           RTS
0351 4C AB E3     JMP $E3AB
0354 A2 02        LDX #$02
0356 BD 3C 03     LDA $033C,X
0359 95 7C        STA $7C,X
035B CA           DEX
035C 10 F8        BPL $0356
035E 60           RTS
035F C9 26        CMP #$26
0361 D0 EE        BNE $0351
0363 20 73 00     JSR $0073
0366 C9 55        CMP #$55
0368 F0 25        BEQ $038F
036A C9 52        CMP #$52
036C D0 E3        BNE $0351
036E A5 02        LDA $02
0370 0A           ASL
0371 0A           ASL
0372 AA           TAX
0373 A5 7B        LDA $7B
0375 9D A7 02     STA $02A7,X
0378 A5 7A        LDA $7A
037A 9D A8 02     STA $02A8,X
037D A5 3A        LDA $3A
037F 9D A9 02     STA $02A9,X
0382 A5 39        LDA $39
0384 9D AA 02     STA $02AA,X
0387 E6 02        INC $02
0389 20 73 00     JSR $0073
038C 4C AE A7     JMP $A7AE
038F 20 73 00     JSR $0073
0392 20 73 00     JSR $0073
0395 20 9E AD     JSR $AD9E
0398 A5 61        LDA $61
039A F0 05        BEQ $03A1
039C C6 02        DEC $02
039E 4C 40 A9     JMP $A940
03A1 A6 02        LDX $02
03A3 CA           DEX
03A4 8A           TXA
03A5 0A           ASL
03A6 0A           ASL
03A7 AA           TAX
03A8 BD A7 02     LDA $02A7,X
03AB 85 7B        STA $7B
03AD BD A8 02     LDA $02A8,X
03B0 85 7A        STA $7A
03B2 BD A9 02     LDA $02A9,X
03B5 85 3A        STA $3A
03B7 BD AA 02     LDA $02AA,X
03BA 85 39        STA $39
03BC 68           PLA
03BD 68           PLA
03BE 4C E4 A7     JMP $A7E4
```

Location	Explanation
033C-035E	This is the initialisation.
035F-0361	See if & character and exit to CHRGOT in Rom if not found.
0363-036C	Get next character from the text and if it is a U then branch forward to $038F — if it is *not* an R then branch back to Goto CHRGOT in Rom — where a syntax error will be generated.
036E-038C	Get the contents of the 'Loop counter' which has been initialised to zero in lines $034D-$034E. Multiply by four to provide an offset and then put into the X register.
038F-039E	The characters & and then U have been identified so bump the text pointers by two (past U and :) and then access a Rom routine to input and evaluate the 'truth' of a condition. If the statement is 'true' then $61 is non-zero so the loop counter is decremented and an exit made to Rom. If "false" i.e. zero then a branch is mae to $03A1.
03A1-03C0	Get the loop counter in A, decrement it and then multiply by four, putting it in an offset to restore the line number and text pointer bytes previously put on the temporary stack. Then pull two bytes off the normal stack and 'throw them away' before accessing a routine in Rom to execute a statement within a line. ■

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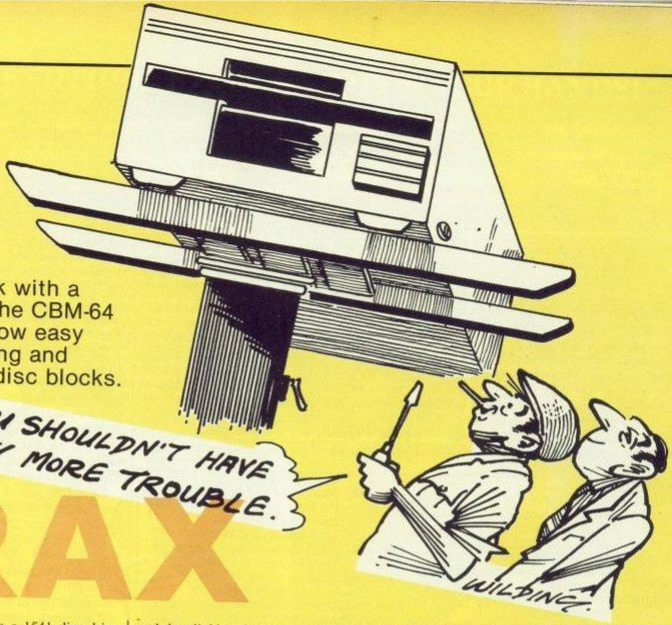

Keith Suddick with a program for the CBM-64 which will allow easy reading, writing and alteration of disc blocks.

TRAX

ANY 64 OWNERS who use a 1541 disc drive may well have gone through the trauma of having it turn six weeks' worth of their latest masterpiece into the kind of garbage that makes random numbers look sensible.

Fear not — as many users may know, this is quite often caused by an error in only one of the many blocks that may be used by the disc drive to store the file. In many cases it is quite easy to fix these errors — if not quite so easy to trace them in the first place.

Consider the way in which the 1541 stores files on a disc, take the most common type — a program file. First of all, the file has to have an entry in the directory. This directory entry contains details of the name, type and length of the file and the track and sector numbers of the block on which the actual file starts.

Each block on the disc is 256 bytes long and the details of the formats are given in the user manual for the disc drive. Briefly, however, in each block the first two bytes, or links, point to the next block in the file and the following 254 bytes are data in the file itself. The last block in a file is marked by links that are invalid track and sector numbers.

When an error occurs on a disc it can corrupt a file in several ways. The error may occur in the data part of the file, changing a character or keyword in a program for example. Another type of error could occur if the links from one block become corrupted and point to an incorrect block as the next in the file.

In both cases the error needs to be found — this may involve careful examination of the file as stored on the disc. Once the error is identified, attempts can be made to correct it, in the case of corrupted links this may involve searching areas of the disc for pieces of the file and then linking them back together. It is not always possible to recover the whole of a file but unless the error is compounded by extensive writing to the disc afte the error occurs, then perhaps only one or two blocks will be lost.

The details of detection and remedy of such errors on a disc is beyond this article and is more related to experience and even reasonable guess-work than a set of rules, but the manuals and reference guides provide all the information on how things are supposed to be stored on the disc and comparison with this should highlight the corruption.

Finding the error will probably mean careful inspection of the data on the disc and then some alterations to correct it. This is where the program Trax becomes useful.

Although the 1541 allows the use of random files, through which it is possible to access any block on the disc in any order, a program is needed to make use of this. While a simple program may suffice to deal with a particular situation, Trax is a more general program which allows easy reading, writing and alteration of disc blocks as well as allowing the use of the 1541's built in DOS commands.

When the program is running it will attempt to identify the disc that you want to work on. It does this by loading in the directory header and block allocation map from track 18, sector 0 and examining it — although the BAM is not used. During execution various things are displayed on the screen in several "windows".

The track and sector numbers of the block currently in the computer's memory are shown along with the track and sector numbers to which the current block is linked or points to. Along the bottom of the screen the disk name, ID and operating system version are shown and below this the error channel form the disc drive is shown.

The largest of the windows on the screen is used to display the actual contents of the block in memory. There is a choice of either hexadecimal or ASCII displays, although editing can only be done hexadecimal mode. Because of the size of a block — 256 bytes — only one half of the block is displayed at any one time, in the bottom right hand corner of the screen is an indicator showing whether the display is the top or bottom half of the block, the bytes are also numbered in groups of eight. Finally, the top lines of the screen are used for communications with the program — prompts will appear here along with any responses that you may type.

In the case of a hard copy version of the display, both the hexadecimal and ASCII data is printed along with the track, sector, name, etc.

The commands provided by Trax are all invoked by single keys to make editing easier, although as a precaution commands that move data to and from the disc are obtained via the control key — Ctrl.

The commands may be summarised:

Ctrl R: Read a specified block from the disc into memory.
Ctrl W: Write the data in memory to the specified block on the disc.
Crtl U: Update the current block on the disc with the data in memory.
Ctrl F: Follow the links from the current block and read the next block if possible.
Ctrl P: Print the current block contents on a printer.
Ctrl Q: Quit the program.

(continued on next page)

(continued from previous page)

*: Switch between ASCII and hexadecimal display modes.

↑ : Switch page to display other half of block.

@: Send following DOS command to disc drive.
In addition the cursor keys and the Home key may be used to move around the block display to edit the data.

Note that all numbers are in hex including the track and sector numbers typed as responses to read and write commands although leading zeros may be omitted. The only exception to this is the error channel which shows numbers in decimal in line with the disc manual which gives more details on error conditions. DOS commands are sent to the disc drive exactly as typed, so the normal syntax applies. In addition, entering just return when asked for a track or sector number will substitute the current value and pressing the CLR key — Shift Home — during a response will cancel the command.

The program is relatively straightforward to type in; the Commodore control codes are as usual. The only exception is line 50 where the reverse characters u,w,f,r,p and x inside the quotes are obtained by pressing Ctrl and the given letter key whilst in quotes mode.

Don't forget to save a copy of the program before trying to use it and I strongly recommend testing it out with a blank but formatted disc to ensure the program is correct.

For anyone who doesn't want to type the program in I can supply tape copies for £2.00, write to: Keith Suddick, 6 Ravel Court, Jarrow, Tyne and Wear, NE32 3BW.

Place the required disc in the drive and run the program. Pressing return when asked will result in the program reading in track 18 sector 0 — the directory header, and getting from this data the name, id and operating system version of the disc. The first page of the block will be displayed along with the links and error channel. When the command prompt appears at the top of the screen you can either enter one of the commands listed above or use the cursor keys to move the "cursor" around the block.

If you want to change a byte in a block then simply put the cursor on that byte and type the new value — remember the values are shown in hexadecimal — you will see the byte change and although it will have been altered in memory the change is not sent to the disc until either an Update command is used to rewrite the current block or a Write command ius used to place the data in any block on the disc. Note that should you change either of the first two bytes in a block — the links, then the link display will change accordingly and any Follow commands will use the new values even if the block has not been written to the disc.

The first directory block is linked to track 18 sector 1 which is the start of the file entries and you can follow this link from the directory header by using the Follow command. The first files in the directory will be in this block and if you switch the display to ASCII using * you will be able to see the file names more easily although you must change back to hex to be able to edit the block.

Since only half of the block is displayed at any time you can see the other half by using the ↑ to change the display.

If you find the file you want in the directory then this entry will tell you where the actual file starts and you can then get the first block of the file using the Read command and then follow the rest of the file — note that Follow will not work from the directory entry as this will link to the next directory block. ■

Program breakdown.

0-90:	Initialisation.
100-180:	Main input loop. Edit block if requested and check for valid commands.
200-260:	Get track and sector numbers for read and write commands.
300-360:	Produce printed copy of current block.
400-499:	Move "cursor" around block display.
500-590:	Execute commands.
600-630:	Display block on screen.
700-760:	Convert to and from hex/decimal.
800-899:	Read specified block from the disc, update current track and sector values and set links to next block.
900-999:	Write current block data to specified block on disc.
1000-1020:	Read and display error channel from disc drive.
2000-2150:	Draw screen "windows".
2200-2300:	Attempted to identify disc — read track 18 ($12) sector 0.
2400-2550:	Error messages for unreadable dics.
3000-3070:	Input a string subroutine.

```
0 rem  trax   1541 disk editor
1 rem  k. suddick  mar 1985
10 dim b(255):cl=214
20 r$=chr$(13):d$=chr$(20):z$=chr$(0):hx$="0123456789abcdef"
30 clr"M"
40 cl$=cl$+"M"+mid$(cl$,2)+"M"
50 ok$="[redacted]"
60 bl$="M":for x=0to8:bl$=" M":next
70 a=16:et=8:u=1:fts=15:t$=40:c3=3:s$=16:c9=9:c7=7:a0=48:c2=2:b8=128
80 s$(0)="list":s$(1)="find":s$(2)="hexadecimal.":s$(3)="ASCII."
90 gosub2000:goto100
100 get k$:if k$=""then100
110 k=asc(k$):if(k<48or k>70or(k>57and k<65)then100
120 pokec2,peek(c2+u):poke2+u,k+64*(k>57)
130 x=cx+cw*t+#b8:b(x)=asc(b(x)and(f)+k-48+7*(k>57)
140 if x<2then Print"M"tab(150)"M link in9" gosub850 Print"M";
150 goto100
160 for x=1to len(ok$):if k$=mid$(ok$,x,1)then next:goto100
170 if x<6then on x goto400,410,420,430,440:goto100
175 on x-5 goto500,510,520,530,540,550,560,300,999
180 print cl$"M Command ?M";:goto100
200 mx=2:ttt:s$=s Print"M"tab(8)
210 Print"M track  M";:gosub3000:if ertherneturn
220 if i$="" then i$=i:gosub750:t=n:goto240
230 ddt:gosub700 Print"M"tab(16)n$
240 print tab(8)"M sector  M";:gosub3000:if ertherneturn
250 if i$="" then i$=i:gosub750:s=n:goto260
260 mss:gosub700 print"M"tab(16)n$:return
300 open4,4,7:print#4:print cl$"M rdcdPr bmin9 Printed.
310 Print#4:"Disk  "dn$"  ID  "id$"  OS  "os$r$
320 ddt:gosub700:print#4,"Track  "n$r$
330 for x=0to15:dw=16:gosub700 Print#4,n$;"  ";a$=""for x=0to15
340 cmb(a$=x+x):dmc if(cand127)<32then c=46
350 a$=a$+chr$(c):gosub700:Print#4,n$;"  ";next
360 Print#4," / ":close4:return
370 close4:return
400 cx=(cx+1)and7:goto450
410 cx=(cx-1)and7:goto450
420 cw=(cw+1)and15:goto450
430 cw=(cw-1)and15:goto450
440 cw,cx=0,
450 if ontheneturn
460 for x=0to1 Poke c+1,Peek(c+1)and127:next
470 c=1140+cw*4+cx*c3
480 for x=0to1 Poke c+1,Peek(c+1)or128:next
490 return
500 Print cl$"Updating block."
501 ttt:s$=s:gosub900:return
510 Print cl$"> Write  ";:gosub200:if ertherneturn
511 gosub900:return
520 Print cl$"Trying to follow link."ttt:s$=n$
521 gosub800:if ertherneturn
522 gosub800:return
530 Print cl$"> Read  ";:gosub200:if ertherneturn
531 goto521
540 Print cl$"Enter DOS command -M" mx*38
541 gosub3000:if ertherneturn
542 close1:Print#15,i$:gosub1000:open1,8,2,"#" return
550 pw1=0:Print cl$"Diaflashing *s(?) Pag*:" goto600
560 dw=1:dw:Print cl$"Switching display to "m$(dw):goto600
590 Print cl$"OK: Cancelled.":for x=1to200:next return
600 Print"[redacted]":for x=0to7:for b=w*8+t*8:d=b:gosub700:Print"M"b1$"M"n$"M";
610 for x=x,to7:d=b(x+bp):if d=then Poke c1149+w+t+4+c3:d:goto630
620 gosub700:Print n$"M";
630 next:Print:next:Poke#1901:226-p*8:b0:goto440
700 h$=mid$(hx$,d/sx+u,u)+mid$(hx$,(d and f)+u,u):return
750 h$="00"+h$:h=asc(right$(h$,2))+a0*(a<(h$[redacted]
760 d=asc(right$(h$,u))+a0:d=d+c7*(d>c9)+1:return
800 Print"M"a$(c150)"M Reading
810 Print#15,"u1:2,0,"t;s:gosub1000:if ertherneturn
820 ttt:s=s:dnt:gosub700:t=n$:dns:gosub700:s=n$
830 Print#15,"b-p:2,0"
840 for x=0to255:get#1,a$:b(x)=asc(a$+z$):next:p=
850 nt=b(0):ns=b(1):dnxt:gosub700:nt=n$:dns:gosub700:ns=n$
860 Print"[redacted]"a$(c206)i$"[redacted]"n$
870 Print a$(c156)nt$"[redacted]"ns$
880 Print"M"tab(150)"
899 return
900 Print"M"a$(c150)"M Writing
910 Print#15,"b-p:2,0"
920 for x=0to255:Print#1,chr$(b(x));:next
930 Print#15,"u2:2,0",t;s:gosub1000:goto800
939 Print#15,"Exit...":close1:Print#15,"i":close15:Print"M" end
999 print cl$"Error!":erk=
1000 Poke c1,22:Print#15,"M":if s=s,then1010
1010 get#15,a$:if s=s,then=s=s+s+s:if s=s,then1010
1020 erm=val(a$):erm$=mid$(a$,2,33-len(a$)):Printer#3"M":return
2000 Poke53280,0:Poke53281,0
2010 Print"[redacted]"
2020 for x=1to16:Print"M" (Ctrl+Q)"M":next
2030 Print"M"
2040 Print"M"  [redacted]  M
2050 Print"M"  [redacted]  M
2060 Print"M"  [redacted]  M
2070 Print"M"  [redacted]  M
2080 Print"M"  [redacted]  M
2090 bl$="M"  [redacted]  M
2100 bl$=bl$+"M"  [redacted]  M
2110 bl$=bl$+"M"  [redacted]  M
2120 bl$=bl$+"M"tab(29)"M"  [redacted]  M
2130 Print"M"tab(29)"M"tab(29)"M" Printtab(20)bl$:bl$="M"
2140 Print"M"tab(29)"M"tab(29)"Current" Print"[redacted]"tab(29)"Linked to
2150 Print"[redacted]"  Press M RETURN M to ID disk."
2200 Print"M"
2210 get k$:if k$=""then2210
2220 print cl$
2230 open15,8,15,"i":gosub1000:if ertherneturn2500
2240 open1,8,2,"M"
2250 tt=18:ss=0:gosub800:gosub1000:if ertherneturn2400
2260 dn$="":for x=144to161:dn$=dn$+chr$(b(x)):next
2270 id$=chr$(b(162))+chr$(b(163)):os$=chr$(b(165))+chr$(b(166))
2280 Poke c1,20:Print#15,"M":dd$=tab(30):id$tab(36)os$:cl$:
2290 p=.:cx,cw=.:cx,cw:goto600:goto440
2400 Print i$"M  Directory error - cannot ID disk.
2410 dn$="":id$="":os$="":goto2200
2500 Print cl$"Cannot initialise drive - unrecoverable
2510 Print" error.  Press M RETURN M to re-start.
2520 close1:if k$=""then2520
2530 if k$=s ertherneturn
2540 if k$="M"then999
2550 goto2520
3000 erm,i$="":Print"M";
3010 get k$:if k$="M"then3070:return
3020 if k$=s ertherneturn:Print
3030 if k$="M"then erm=erm-1:if erm=0then3010
3040 if k$=d$then if i$()""then i$=left$(i$,len(i$)-1):Print d$;:goto3010
3050 if asc(k$)and127)<32then3010
3060 if len(i$)>30then3010
3070 i$=i$+k$:Print k$";:goto3010
```

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It's the year 2085. Only a handful of people have survived the robot wars that rocked the Solar System. In a final desperate bid for survival a Tacheon propelled star cruiser has been developed on Earth to transport survivors to new star system. But the cruiser relies on rare Ionian crystals for its power; crystals which are only abundant on Jupiter's second moon Io. A moonbase established on Io is under constant attack by aliens from Jupiter. It is your mission to escort the men and their precious crystals safely from the surface of Io to the Dropzone where the landing pad is located. You are equipped with the latest pulse-laser back-pack system which will make you invisible and indestructible for short periods of time. You must succeed, the future of the human race depends on you alone!

64

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SPACE JUNK

Nalin Sharma continues his epic for the CBM-64.

HERE IS a reminder of the loading and game instructions for Space Junk.

Insert cassette, press Shift and Run/Stop and start your cassette recorder. Loading time is about two minutes. Put your joystick into Port 2.

Can you retrieve all 32 satellites by mastering control of your ship, which can move up, down, left and right and can also fire bullets?

However, beware of the four yellow junkies which patrol the skies. Unless you can work out how to destroy them you're in trouble! To help you there's a radar at the top of the screen which will pinpoint the junkies and any miscellaneous junk which appears from time to time and can be retrieved for bonus points.

After every two sheets you'll get an extra life and an attempt at the challenge stage. Here you have 99 units of time to turn the four junkies into stormer — if you succeed you'll get 8000 points! Below your score is shown the number of satellites left to collect, together with the level.

Pressing F7 will freeze the game and pressing the Space-Bar will restart it. Tape copies of the program are available for £3.25 from Nalin Sharma, 35 Kitchener Road, Walthamstow, London E17 4LJ.

```
note: enter letters in
capitals
3400 k19a53544120483 2a4
3408 474848b9aa35000b 279
3500 3b668a4c44412023 289
3508 3600|b35bb8a5354 272
3510 412048947448b8b3 282
3518 aa36002635ca8a4c 24b
3520 44412023500525 167
3528 d48a53544120534 301
3530 49454c44004c05e8 281
3538 8a4a535220534554 285
3540 52414441520073 146
3548 +48a5349c3434520 385
3550 4c44582023000c 1c7
3558 35+68a9c53494420 351
3560 4c44412023544e 23c
3568 442c58007d35+88a 24c
3570 535441204455053 244
3578 49442c58008835+9 2c7
3580 8a4c44412023000 1ce
3588 9935+a8a53544120 35a
3590 574849434832c58 229
3598 00a1354b8a494e58 34a
35a0 00a035+c8a435056 353
35a8 2023023500ba35+a 297
35b0 8a4244e5209c5343 2c7
35b8 4400c235109b5254 27c
35c0 5300d735748b5241 2f1
35c8 53549a34204c4441 266
35d0 205341543591ce2 0ce
35d8 357e6b434d502023 261
35e0 3100+235868b424e 24b
35e8 452046494e524153 228
35f0 3400033692b4a53 227
35f8 52204254c4c4034+ 233
3600 4c53001436978b4a 255
3608 535220534849043 23c
3610 44e53002593c8b 270
3618 4a5352204d495343 23c
3620 48444c52003536e5 23c
3628 8b46494e52415334 282
3630 202c3000d22+8d+2 24c
3638 563252454c204259 226
3640 542032438203234 1a4
3648 392c023534203235 193
3650 3000ed2493+25632 356
3658 5741564520425954 242
3660 2033332233332b33 177
3668 332c533300353094 1ce
3670 +2545754+554+44 326
3678 204259542030232 16d
3680 34302c31362c3232 187
3688 342c3322c3230333 18c
3690 2c34382c31393222 18c
3698 36342c31372c038 198
36a0 302c31363002c9936 18a
36a8 2c31343420c311131 18f
36b0 2c31238007e309+ 213
36b8 +2485950534+554 328
36c0 442042595420322 1a7
36c8 31362c3332203438 190
36d0 2c36342c38302c39 18+
36d8 362c31313202c3131 18f
36e0 382c31343420c3136 190
36e8 302c31373620c3139 190
36f0 322c32303620c3232 188
36f8 342c32343000c730 1ed
3700 a6+2524546534+55 36e
3708 4e442042595420322 1+3
3710 34302c3232342c32 186
3718 30382c31393222c31 18d
3720 37362c31363002c31 18d
3728 34342c31323822c31 18c
3730 3122c339062c9830 19c
3738 2c36342c34382c33 18d
3740 322c31362c3000e1 202
3748 30b2+291534204z 35d
3750 5254203936z2c3134 1cd
3758 342c06342c317736 194
3760 00+23018+6802022 2+2
3768 553041434532222c 1ec
3770 3300000005c8c4445 1a9
3778 5300b375+6c4a53 2a2
3780 522054c4+54534l 245
3788 5453009337648c52 2c3
3790 545300a37698c52 2d3
3798 4153549a32204+44 264
37a0 412053415433120 24d
37a8 21c454c5400b937 23c
37b0 5e8c434d502023l 24e
37b8 00c537738c424551 2d3
37c0 20acaa3300cd3778 325
37c8 8c52545300ac277d 315
37d0 8c4c44582053434l 26b
37d8 504553000e378283 320
37e0 4a5352204434c4541 224
37e8 5253415453004+37 2c1
37f0 87824c4458205243 2c1
37f8 415045580005388 9+4
3800 03030+0+3+3++++ 2a0
3808 ++++++++++++++ 7+8
3810 80a0e8eata+ata+t+ 6e2
3818 00000000a0a0aaa 272
3820 aaaaaeaa+ata+t+c 716
3828 80a0a0a0a0a0a0a0 2c0
3830 0000000000010205 008
3838 ea12a548902040b+ 398
3840 7+000000001+00++ 27e
3848 ++00++0010306+c 304
3850 +83060c000++00++ 4c6
3858 ++00++c00000001 33+
3860 010307060+1830+8 160
3868 00181818181b3c0c 0+0
3870 6666667e66c3++c3 49b
3878 c37ec300++000000 303
3880 80c0e060+0180c1+ 3c3
3888 0000000000000003 003
3890 0+1+3+3d3+1+0+01 118
3898 0000000000++++ 20a
38a0 b++b++++dd++++++c 78+
38a8 00000017+++d++b 359
38b0 ++dd+++7++++e000 6b0
38b8 00000++++++ugu++ 4d9
38c0 e++++bb+++e0000 5a5
38c8 0000000e0+3+0+c6a 432
38d0 e++++bet+c0000000 498
38d8 10383867cbee6+7 313
38e0 +++7b++eee+ebd+3 759
38e8 ebd3b63b6d+d++c+ 5ec
38f0 0000000101032377 09+
38f8 7b+b+bd3+deebd++ 6ee
3900 0000000000000000 000
3908 dd+d7dedfb+3+7e+ 718
3910 000081c1c367e7ed 440
3918 ef66+6b3dc+b+677 6c3
3920 b7cdabe+66+7db++ 685
3928 c0c8e4eeeb6++7+6 699
3930 b6+57b6bbdb5ieda 5b+
3938 e+afb7+ar9cdb6++ 6ca
3940 0006338c63cc63cc 2a3
3948 338+03030303030c 096
3950 0060cc30c633c633 34e
3958 cc70c0c0c0c0b0dc 5c8
3960 0000000001818380 060
3968 0000007e000000007 07e
3970 ++++++++++c+c+++ 798
3978 00404060607030338 218
3980 1c1e0+8703000000 053
3988 0000000e0+83e000 296
3990 0000001818000000 030
3998 000000c3dcdb++db 452
39a0 dbe7db++dbe7db++ 738
39b0 e7++db++++db++7a 717
39c0 5555++dbe7e75ac3 56+
39d0 e7e7++++7e000000 44a
39e0 6666++++c3bd9999 57c
39f0 bdc3++++7e000000 3+c
3a00 ++++815s57545380 46a
3a08 ++++9177+d5++b44 561
3a10 ++++0345dd79ed03 53c
3a18 ++++++87++87++++ 708
3a20 ++c3dbd+d+dbc3++ 6+8
3a28 ++c7bbr7e++++++ 754
3a30 ++++++++++++++++ 74b
3a38 ++++033303333++ 39c
3a40 ++++0733073307++ 378
3a48 ++++033333+3303++ 3a6
3a50 ++++0733333307++ 3a4
3a58 ++++033+073+03++ 388
3a60 ++++033+3333+++ 3a8
3a68 ++++3333033333++ 3ae
3a70 ++++033333333++ 3ce
3a78 ++++033333330++ 39c
3a80 ++++0333033+3++ 3b4
3a88 ++++033303+3+3++ 51c
3a90 ++++0733073333++ 3a4
3a98 ++++033+03+303++ 438
3aa0 ++++03c+c+c+c+++ 63c
3aa8 ++++3333333303++ 3cc
3ab0 +++3333333330++ 498
3ab8 ++++3333330333++ 3cc
3ac0 ++++3333c+3333++ 498
3ac8 ++++333303+303++ 45c
3ad0 ++++03+3c+3+03++ 504
3ad8 0103060c183+60++ 1cc
3ae0 0103070c183060c0 17+
3ae8 8000000103++00++ 282
3af0 ++00++0103060c1+ 233
3af8 3+60c08000++00++ 3dc
3b00 ++00++8000102e4 365
3b08 c912244890a+40++ 3c5
3b10 0000000000000000 000
3b18 00000000000++++ 1+e
3b20 0000000++++0000 1+e
3b28 0000++++00000000 1+e
3b30 ++++0000000000000 1+e
3b38 0000000000000000 000
3b40 0306c1830e0c000 27d
3b48 ++06+c1830e0c000 3e9
3b50 0018185a3cdb7e18 237
3b58 00000183c187e18 102
3b60 00c0d6db+b1b1+18 3c0
3b68 000187810180000 0c6
3b70 00000007ee7e37e 2c6
3b78 0000000001e391+ 075
3b80 0000000000000606 00c
3b88 0000000c000000 03c
3b90 0000000018000000 018
3b98 1+7++00000c0+03c 3+a
3ba0 ++c000000000007+ 23e
3ba8 c3030101010++++ 2cb
3bb0 ++++c3c3c3c3++++ 708
3bb8 ++++ebebebebb+++ 7a8
3bc0 ++++d7d7d7d7++++ 758
3bc8 ++999999++9999++ 660
3bd0 ++e7e7++9999++++ 6+c
3bd8 3+++c3c3c3c3++++ 548
3be0 +c++c3c3c3c3++++ 705
3be8 0103070+1+3+7+++ 1+6
3bf0 90c0e0+0+8+c+e++ 701
3bf8 000000003c3c5555 122
3c00 0103070+1+3+7+00 0+7
3c08 ++99++99++99++++ 6c6
```

Available on Telsoft.

```
3c10  ++beebff+bebb++++ 7a8
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3f48  ++00++++++00++ 5+a
3f50  ++00++++++00++3 53e
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5210 bd4668aaaa0d0c9 45b
5220 d0d0d6a2a48a48a0 52e
5230 d5201a49205249a2 2b8
5240 a20a20b4668aaa0 3ed
5250 9c00aa0a20a20bd46 42f
5260 ee01d0a01d0c9b0 4c1
5270 d0+1a90a8d2c0d3 4ae
5280 94a0d8a21920149 347
5290 203649a94965e85 396
5300 +1d0b685+cae8a5 535
5310 +ea907a2b1201b45 331
5320 a99d0a0c201a4920 346
5330 5249a21420bd46a3 31d
5340 c5200949207c4ae 2ef
5350 00d0ce00d0ad0d0 3eb
5360 203649a94965e85 396
5370 +1d0b685+cae8a5 535
5380 +ea907a2b1201b45 331
5390 a99d0a0c201a4920 346
5400 5249a21420bd46a3 31d
5410 c5200949207c4ae 2ef
5420 00d0ce00d0ad0d0 3eb
5430 c9ad0d6e207e4620 423
5440 7e46207e46207e46 28c
5450 a906a26820b45a9 2e4
5460 b5a0cb201a49205 318
5470 a49b0a0ce201a49 39b
5480 205249a9b7d28d0 24f
5490 d0a20a20b4668aa 3d6
54a0 d3d0ee0d5d020d150 3d7
54b0 a0d3d0c3d7d0ea9 584
54c0 b6d+907a91d0d2 395
54d0 d0a20b20b4ee0d2 38c
54e0 d0ee05d020d150ad 481
54f0 05d0c9e1d0eb a9a 59e
5500 8+a07a93e0d04d0 3d6
5510 a90805985d65507 24a
5520 e015a200948d48 389
5530 a20b20b46aa0d20 349
5540 136901900748a902 20c
5550 9a10d0688d02d0ad 3e1
5560 04d038e901d00748 2e5
5570 a9006d10d0688d04 30e
5580 d020d150ad20d0c9 45b
5590 4ed004a901f50ad 3a4
5600 d0c9d0d004a901 327
5610 850768aa68a8ad18 36b
5620 d0c902d00aad02d0 3e4
5630 c93ed0d34c94e46 364
5640 05a505c908d09a48 3ee
5650 008505a506c901d0 2cc
5660 16e16e007a90085 311
5670 d64c74ea a9a51 328
5680 07a901d5d1dbe5a5 407
5690 07c901d034c644e 22c
56a0 c0++d007a9005507 3cb
56b0 4c644ea90a997907 2ca
56c0 a901997b4b884c64 3c+
56d0 4ea9b884+907a938 41d
56e0 5d02d0a20a20b46 32e
56f0 ce04a9ee03d020d1 454
5700 5a0d04d0c9ia0d4ee 46d
5710 a9b88d+a07a5208d 445
5720 04d0a20720b46ee 36e
5730 03d0ee05d020d150 3d7
5740 ad03d0c9eed0ea9 59b
5750 1a8d04d0a9b6d0+a 461
5760 07a93e0d020a9ba 3b0
5770 +07a93e0d020a9ba 3b0
5780 8d+907a20520bd46 357
5790 ad02d038e901b007 358
57a0 a9a9006d10d0688d 353
57b0 02d0ee04d020d150 3d5
57c0 ad04d0c9a8d0dca9 53f
57d0 b6a0cf201a492052 31a
57e0 49a9cf8d+a07a9ba 4b2
57f0 a8cc201a49205249 2aa
5800 a9cc8d+907a2009a 42e
5810 48a9cf200949206b 308
5820 4ba9cb200949207c 2cc
5830 4aa2042bd4668aa 325
5840 e8e018d0e2a9888d 550
5850 02d0a9b88d04a9 43d
5860 478d1dd0a9bca0d 493
5870 201a49205249a9bc 2a3
5880 a0ce201a49205249 2ac
5890 a2008a48a9cc2009 312
58a0 49207c4aa9ce2009 2cf
58b0 4920b64aa20420d 2ec
58c0 4668aae0e0d0d2 4de
58d0 a9a0d0d0a9ee8d 4d6
58e0 0dd0a9078d2d0d9 3d8
58f0 bc8d+07a9d15 492
5900 d0aedb52c901+003 347
5910 4ca150a2008a4f+ 3a4
5920 5107a2120bd4668 29e
5930 aabd5107c9d0d0d 452
5940 8a48a200a9dd8d 308
5950 20d34868aa48a93e 37c
5960 9d5107bd3952d03e 31b
5970 a2192d0d4668aad 37c
5980 3952d5107e8e01d 35e
5990 d0c3a200a48a79 47e
59a0 07a21920bd4668aa 247
59b0 0d7907c9d0d0ed5a 45a
59c0 48a200a9dd0a20 29e
59d0 d34868aa48a93e9a 349
59e0 7907bd4452a0ea2 35e
59f0 1920bd4668aad4 3c
5a00 529d7907e8e01d3 41d
5a10 c3a20a20d4ee0d3c 36c
5a20 d0ad0cd0c55ed0+1 541
5a30 a20a20d4ee0d0d 399
5a40 ad0c0d0c9ed0+1a2 596
5a50 0a20d46ee0c0ad 384
5a60 0cd0c9add0+14c52 4a4
5a70 53ad+907a91d0+9 3d0
5a80 07ad+a0749018d+a 306
5a90 0768a8b8e8+91 92 3bc
5aa0 9596999a9d9e9+a0 4d8
5ab0 0c8d902093949798 41+
5ac0 9b9c20a1a2a3a4a8 489
5ad0 a2acadb0b1a5a6a7 555
5ae0 aaabaeafb2b34601 45e
5af0 203d2044+e452050 1cf
5b00 4c41594552204741 225
5b10 4a454603203d2054 1ac
5b20 574+205041415945 241
5b30 522047414d4a5245 2c9
5b40 4e4b4955452a+4+ 26b
5b50 504552535444524d 27c
5b60 455254445204a55 237
5b70 4b45504c41594552 25e
5b80 200150+c41594552 1ee
5b90 200250d41592054 1cc
5ba0 484520474140520 1e7
5bb0 4c4646445220c45 22a
5bc0 56454c2d0d0cc1d9 44a
5bd0 c5d201112d171819 22d
5be0 1a1b1c1d1e1f2021 0e8
5bf0 22232425262728d2 130
5c00 d0cc1d9c5c21213 4f2
5c10 204741d4d520204+ 66
5c20 564552434841+c5 251
5c30 4f4574520205354 206
5c40 414754520010908 13+
5c50 054e414c434fe2053 1ea
5c60 4941524d41b4c5b6 398
5c70 b7b8b9abbbcbdbe 5d4
5c80 b+202020+e5920+ 235
5c90 4b2a012a00000000 8a4
5ca0 00000000a2202020 884
5cb0 52ae452e20202023 17f
5cc0 20202022e0000000 89c
5cd0 20202022e0202023 89c
5ce0 2048ce4e2e202023 17f
5cf0 20202020232e0000 0b1
5d00 00000000000e2a20 8a4
5d10 20204524e4120202 162
5d20 20202022544+50 133
5d30 20032513434+5245 1+5
5d40 53d4c9c9d32bc7c1 54d
5d50 cdc5d2c9d32bc4c5 511
5d60 c4c9c3d4c5c4d4 642
5d70 c+d3d3+cdc5c+c5 5e8
5d80 c5d2c5d2c+cec3c5 58d
5d90 2cb0cec5d7414e43 43b
5da0 454853000000000 0a0
5db0 00000000cac00000 13b
5dc0 000004010313334 070
5dd0 3536243031323337 197
5de0 383935393935733 1b6
5df0 6069c4cb5c6d0000 27+
5e00 0008200+00000000 037
5e10 084100+100000000 142
5e20 00000000000+44 0da
5e30 4120233000c352ad 276
5e40 615354412034154 251
5e50 5391000520c2153 36c
5e60 54412053aa333200 217
5e70 dd52b0c153544120 354
5e80 53aa333300+25226 36d
5e90 614a5352204344c45 244
5ea0 415253505249544 26a
5eb0 5300++52bc614a53 36d
5ec0 52205c415354000c 202
5ed0 554e54312c58000+ 1ee
5ee0 531c4754541001 21a
5ef0 532ca7434c430024 216
5f00 5330a7414442023 235
5f10 323136002c533aa7 14c
5f20 504841003454aa7 24b
5f30 544159004154aa7 277
5f40 4441202331393 1ae
5f50 4c706740d9594c0 239
5f60 594cea564cda504c 3b1
5f70 c058a2+19a20a44 49e
5f80 a900051320d75320 2d0
5f90 0+542a6a420c053 24b
5fa0 4cbc53a9b685+b85 4c1
5fb0 +da90585+ca9985 533
5fc0 +ea907b8017b0ea9a 434
5fd0 4a2b4a00ea91a20 2c4
5fe0 954a207e46207e46 2a3
5ff0 a907b8017b00aa2 2+a
6000 d0a923209546207e 265
6010 46207e46a00a219 28+
6020 209846a00aa22020 29c
6030 7e46207e46209846 2ae
6040 ca9a466a9a908512 34e
6050 209055a9015115 2da
6060 10a20120bd46a512 26b
6070 c++a9+54c+0aa2 5c5
6080 008a951b6e000d0 3da
6090 +8a901852385a2a 396
60a0 00207061a901a220 25d
60b0 207061a9005ca9 247
60c0 008533852585a2a9 2d2
60d0 2585a2b2a90585 2de
60e0 2585a2b6b5560a9 2c1
60f0 9320d2++a906d23 3eb
6100 d0a9096d22d0a900 3aa
6110 85+b55+ba9045+c 530
6120 a9d855+ea9045+c 530
6130 7ba299a01a90c20 328
6140 954ea01da20e817 3b+
6150 205546a9096a0170 2ac
6160 a00ca2a3a91a2095 36b
```


To be continued.

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AMSTRAD
48K SPECTRUM

TASWORD TWO

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"If you have been looking for a word processor, then look no further."
CRASH June 1984

"The number of on-screen prompts, together with the excellent manual, make it ideal – even for an absolute beginner."
PERSONAL COMPUTER WORLD September 1983

"Without doubt, the best utility I have reviewed for the Spectrum."
HOME COMPUTING WEEKLY April 1984

TASWORD TWO ZX 48K Spectrum £13.90

TASWORD MSX

The Word Processor

The Tasman Word Processor for MSX microcomputers.
All the features of the Spectrum version.

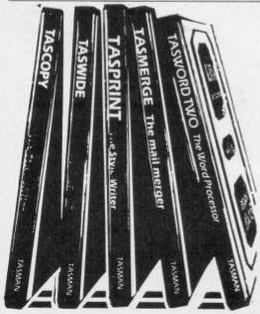
TASWORD MSX MSX Computers £13.90

TASCOPY

The Screen Copier

Screen copy software for Spectrum with Interface 1 and Amstrad CPC 464. Print high resolution screen copies (in a choice of sizes), and also large 'shaded' copies with different dot densities for the various screen colours. Tascopy supports all eight pin dot matrix printers with Epson type control codes, e.g. Epson RX-80 and FX-80, Shinwa CP-80, Mannesmann Tally MT-80, Star DMP 510/515, Brother HR5, and also Amstrad DMP 1 with the CPC 464.

TASCOPY ZX Spectrum £9.90
TASCOPY 464 Amstrad CP 464 £9.90



TASWORD 464

The Word Processor

The Amstrad implementation of Tasword Two plus many extra features.

TASWORD 464 Amstrad CPC 464 £19.95

TASMERGE

The Mail Merger

Transfer data from MASTERFILE to TASWORD TWO! Letters and forms typed on TASWORD TWO can be printed with addresses and data taken from MASTERFILE. The mail merge facility allows, for example, multiple copies of a letter to be printed, each containing a different name and address taken from your MASTERFILE data. To use TASMERGE you must have one or more microdrives as well as TASWORD TWO and MASTERFILE by Campbell Systems. (version 9 or later).

TASMERGE ZX 48K Spectrum £10.90

TASPRINT

The Style Writer

A must for dot-matrix printer owners! Print your program output and listings in a choice of five impressive print styles. TASPRINT utilises the graphics capabilities of dot-matrix printers to form, with a double pass of the printhead, output in a range of five fonts varying from the futuristic DATARUN to the hand-writing style of PALACE SCRIPT. TASPRINT drives all dot-matrix printers with bit image graphics capabilities and can be used to print TASWORD text files. TASPRINT gives your output originality and style!

TASPRINT ZX 48K Spectrum £9.90
TASPRINT Amstrad CPC 464 £9.90

TASWIDE

The Screen Stretcher

With this machine code utility you can write your own Basic programs that will, with normal PRINT statements, print onto the screen in the compact lettering used by TASWORD TWO. With TASWIDE you can double the information shown on the screen!

TASWIDE ZX 48K Spectrum £5.50

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Plug into your Spectrum and drive any printer fitted with the Centronics standard parallel interface. Supplied complete with ribbon cable and driving software. The user changeable interface software makes it easy to send control codes to your printer using the method so successfully pioneered with TASWORD TWO. The cassette also contains fast machine code high resolution full width SCREEN COPY SOFTWARE for Epson, Mannesmann Tally, Seikosha, Shinwa, Star, and Tandy Colour Graphic (in colour!) printers. Compatible with microdrives and ZX Interface 1.

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TOP★TIPS

MEMORY LOOK

To enable the contents of the memory holding a Basic program to be examined I have written the following utility which uses line numbers from 9000 onwards. This allows it to be added to the end of existing programs using Merge "" instead of Load "".

Once installed the direct command Go To 9000 should be used to execute the routine. The screen is filled with the memory locations, the corresponding contents in decimal and where applicable the ASCII character or keyword.

The "scroll?" prompt appears after each screen fill and allows you to stop by pressing key N.

Alan Pratt

```
9000 REM Enable memory
9010 CLS : LET s=PEEK 23635+PEEK
 23636+256: GO TO 9010
9020 LET P=PEEK s
9030 IF P=13 THEN GO TO 9200
9040 IF P=14 THEN GO TO 9300
9050 IF P<10 THEN PRINT P;
:
9060 IF P>9 AND P<100 THEN PRINT
" ";P
9070 IF P>99 THEN PRINT P;" ";P
:
9080 IF P<31 THEN PRINT PAPER 5;
CHR$ P
9090 IF P>32 THEN PRINT
9100 LET s=s+1: GO TO 9020
9200 PRINT ": PAPE
R 4 : END OF LINE ": PAPE
9210 LET s=s+1: LET s=PEEK s+256
*PEEK (s+1)
9220 PRINT s " : PAPER 6;"Line
No. ";s
9230 LET s=s+2: LET s=PEEK s+PEE
K (s+1)*256
9240 PRINT s " : PAPER 6;"No.
";s
9250 LET s=s+2: GO TO 9100
9300 PRINT ": PAPE
R 4 : "Dump ";s;" at"
9310 PRINT s;:
9320 FOR i=1 TO 4*5
9330 PRINT " PEEK ";
9340 NEXT i
9350 PRINT : LET s=s+5: GO TO 91
00
```

HEX-DEC/DEC-HEX

This is a machine-code program which is for the CBM 64 and readily converts either hexadecimal to decimal or decimal to hexadecimal.

To do this you simply type the following:

for dec/hex
SYS 49152,***** (decimal number)
for hex/dec
SYS 49242,$**** (hexadecimal number)

Gary Taylor

```
30000 REM HEX-DEC & DEC-HEX
30010 ADD=49152:C=0
30020 READ A:IF A=0 THEN END
30030 POKE ADD+C,A:C=C+1:GOTO 30
020
30040 DATA 32,253,174,32,138,173
,32,247,183,170,152,72,72,138,72
,72
30050 DATA 169,36,32,210,255,184
,32,38,192,184,32,43,192,184,32,
38
30060 DATA 192,184,32,43,192,96,
24,106,106,106,106,41,15,24,105,
48
30070 DATA 201,58,144,2,105,6,32
,210,255,96,234,234,234,32,115,0
30080 DATA 201,58,41,15,144,2,10
5,8,96,32,61,192,10,10,10,10
30090 DATA 133,35,32,61,192,181,
35,133,35,96,32,115,0,201,36,240

30100 DATA 3,76,0,175,32,73,192,
133,34,32,73,192,165,34,166,35
30110 DATA 32,205,189,76,116,164
,234,234,-1
```

RESPONSE *Frame*

Do you have a problem related to your micro? Tim Hartnell will do his best to help. Please include only one question per letter and mark it "Response Frame". Alternatively, perhaps you have an idea you'd like to pass on to others. Why not write to us with your top tips?

BBC FILL-IN

■ I have owned my BBC Model B computer for over eight months and have not experienced any problems with it until now. I discovered the problem when I accidentally used a recently-obtained "fill" routine on a screen full of text. When the routine encounters the text, the computer locks up, and I have to resort to the Break key, or it produces a variety of very strange error messages, depending on which graphic mode it is used in. The "fill" routine uses the Point command and it is the lines which contact this command which produce the error messages. To start the routine, I used the command Procfill (500,500). I would be pleased if you could tell me if the fault is in the programming, if it is a universal fault in all PS 1.2's or if it is just my computer at fault. Here is the offending program:

```
10 DEFPROCFILL (X%, Y%)
20 CLEAR
30 X = X%:Y = Y%
40 IF POINT (X,Y) = 0 THEN PLOT
   69,X%,Y%
50 IF POINT ((X + 4),Y) = 0 THEN
   PROCFILL ((X + 4),Y)
60 IF POINT (X,(Y + 4)) = 0 THEN
   PROCFILL (X,(Y + 4))
70 IF POINT ((X – 4),Y) = 0 THEN
   PROCFILL ((X – 4),Y)
80 IF POINT (X,(Y – 4)) = 0 THEN
   PROCFILL (X,(Y – 4))
```

Darren Powell,
Thorne,
Doncaster.

THE PROBLEM lies in the program, not in the operating system or your computer. For a start, you should not use Clear within a procedure as this strips the return address for exiting the procedure from the stack, so it can return to almost anywhere in the program.

The BBC Micro generates meaningless random error messages under certain circumstances, so the content of the messages you have generated is irrelevant. Your routine, even without the Clear, is probably the least sophisticated "fill" routine possible. As it is recursive, it is also very, very memory-hungry.

It probably consumes around 60 bytes every time it calls itself. When you try to "fill" on a page of text, more than half the screen is blank, so the number of self-calls will be huge, giving rise to the problems you've experienced. I suggest you delete the Clear, and only use your routine for filling relatively small shapes.

COLOURED MAN

■ I have an Amstrad computer and am presently writing a program in Mode 1. I want to include a figure of a man, made up of five user-defined graphic shapes. However, I want to mix colours within particular defined graphics and cannot figure out how to do this. Can it be done?

M Smith,
Stoke-on-Trent.

MODE 1, AS you know, gives four colours but there is no way in Basic which I can discover which will allow more than one colour to be used for a user-defined graphic. Although this would doubtless produce a program which ran more slowly, you could user Line and Draw to construct your figure as these do allow you to do colour changes.

WHICH MODEM?

■ I am looking for help on the subject of modems for the Electron. I am interested in buying one, but am not sure which are available.

Richard Rennie,
West Calder,
West Lothian.

I HAVE BEEN unable to locate any modems made specifically for the Electron. If you get an RS-423 interface for your Electron, you will then be able to hook your computer to any modem made for the BBC. In fact, with this interface, you'll probably be able to use any standard 1200 baud modem.

CBM-64 SOUND

■ In a recent edition of *Your Computer* magazine I saw an advertisement for a "digital sound sampler" for the ZX Spectrum. I own a Commodore 64, and wonder if there are similar products available for it?

Stewart Sadler,
Tollesbury.

WHILE I have not been able to track down a sound sampler as such, I've discovered that many of the music synthesiser programs available for the 64 give you the capability of generating many non-musical sounds. The *Commodore Music Maker*, which you might have seen, includes a small keyboard which actually sits on the Commodore's keys, and comes with driver software. If you want to generate speech, the cassette program from an American company, *Big-Mouth*, is available. There is also the plug-in speech module from Commodore called *Magic Voice*.

VIC DISC DRIVE

■ I am a Vic-20 owner, and after a couple of years' computing I now wish to invest in a disc drive. The obvious choice is the Commodore drive, but this is fairly expensive.

Andrew McFarlane,
Sheffield.

THE EASIEST route to follow is to buy an RS-232 interface for your Vic-20, which will give you the ability to choose from a very wide range of disc drives — and, incidentally, other peripherals as well.

AMSTRAD COLOUR

■ I am considering buying an Amstrad CPC-464. However, there is one thing I have not been able to find out from the articles which have been printed on it. If I buy a green-screen monitor version, can I plug the computer into a colour television? If I can, will it produce a colour picture, or is the "colour circuitry" only provided with the colour version?

Anthony Hodgson,
Sunderland.

THERE IS only one type of Amstrad machine, in terms of its ability to produce a colour picture. The only difference is in the monitor provided with the one you buy. You cannot connect the CPC-464 up directly to a colour television. However, Amstrad make a modulator, costing around £30, for this purpose.

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IDC AMPHENOL (Centronics)

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36-way socket	£5.95

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20-way	.30	.50
24-way	.36	.60
25-way	.40	.65
26-way	.45	.70
34-way	.60	.80
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Listing 1.

```
  15 RESTORE 20: FOR a=USR "a" T
O USR "o"-1: READ b: POKE a,b: N
EXT a
  20 DATA 0,0,0,7,15,26,24,24,24
,0,0,255,255,0,0,24,24,24,24,24
,24,24,24
  30 DATA 0,0,0,224,240,56,24,24
,24,24,56,240,224,0,0,0,24,24,28
,15,7,0,0,0
  40 DATA 189,255,189,60,24,153,
255,153,231,66,242,255,255,242,6
6,231,0,0,0,24,24,0,0,0
  50 DATA 231,66,79,255,255,79,6
6,231,153,255,153,24,60,189,255,
189,137,82,85,62,188,98,42,201,2
4,24,255,255,24,24,24,24,24
  55 DATA 126,195,165,153,153,16
5,195,126
  60 DATA -2,-10,50,5,-2,-10,-5,
-5,-2,-10,50,5,-2,-10,-5,-3
  65 DATA -3,-10,50,5,-3,-10,-5,
-1,-15,0,-15,-1,-15,-3,-15,-1,-
15,-3,-15,-5
  80 DATA -4,0,50,1,-4,-5,-2,-4,5
0,1,-2,4,50,1,-2,4,50,1,-2,4,-1,
2,-3,0,-1,-1
  90 DATA -1,-5,-1,-5,-3,4,-3,-5
,-3,4,-3,-5,7,4,1,-5
  190 LET h1=0
  200 LET le=1: LET li=3: LET h=2
: LET s=0
  205 FOR m=500 TO 300 STEP -100
  210 LET p=0: GO SUB 1000: PRINT
#1;" SCORE";s;TAB 16;"HIGH";h
i
  211 LET f=m: PRINT AT 7,23;"FUE
L";AT 12,23;"LIVES";li
  215 PRINT AT 9,9; INK 5;"H";AT
9,10; BRIGHT 1; INK 2;"M"
  213 LET d=8: LET i=5: LET ti=5
  214 RESTORE 60: LET r=INT (RND*
15): FOR a=1 TO 16: READ b,c: IF
b=50 THEN PAUSE c: GO TO 216
  215 BEEP b,c+r
  216 NEXT a: LET ts=0: LET x=9:
LET y=x: LET xf=12: LET yf=x: RA
NDOMIZE
  220 LET ch=152: LET x1=x: LET y
1=y: LET xf1=xf: LET yf1=yf: IF
NOT f THEN GO TO 350
  225 LET o=1: LET a$=INKEY$
  230 IF y>9 AND y<13 THEN LET x=
x+2*(x<9 AND a$="1" OR x>11 AND
x<20 AND a$="3")-2*(x<12 AND a$=
"1" OR x>11 AND x<20 AND a$="0")
: IF x>1 THEN LET ch=ch+x-x1: L
ET l=l+(a$="1")-(a$="0")
  240 IF x>9 AND x<12 THEN LET y=
y+2*(y>9 AND a$="3" OR y>11 AND
y<20 AND a$="0")-2*(y<12 AND a$=
"1" OR y<11 AND y<20 AND a$="0")
: IF y<>y1 THEN LET ch=ch+2*(y-y1
): LET o=1: LET l=l+(a$="0")
  310 LET a=USR 23040
  320 IF a=0 THEN LET s=s+5: LET
ts=ts+5: BEEP .005,0: IF ts=179
THEN GO TO 510
  330 IF a=5 THEN LET s=s+50: BEE
P .1,20
  340 PRINT #1;AT 1,7;s
  350 IF x=xf AND y=yf THEN GO TO
1100
  360 LET ch=152: IF RND<h<1 THE
N GO TO 450
  380 LET a=(l1<l)-(l1>l)
  385 IF l<l1 AND o=1 OR p THEN
LET p=NOT p: GO TO 450
  390 IF yr>9 AND yr<12 THEN LET
xr=xr+2*(xr<9 AND a=1 OR xr>11 A
ND xr<20 AND a=-1)-2*(xr<12 AND
a=1 OR xr>1 AND xr<10 AND a=-1)
: IF xr<>xr1 THEN LET ch=ch+xr-xr
1: LET l1=l1+a
  400 IF xr>9 AND xr<12 THEN LET
yr=yr+2*(yr<9 AND a=1 OR yr>11 A
ND yr<20 AND a=-1)-2*(yr<12 AND
a=1 OR yr>1 AND yr<10 AND a=-1)
: IF yr<>yr1 THEN LET ch=ch+2*(yr
-yr1): LET l1=l1+a
  450 LET a=USR 24011: IF NOT a A
ND RND>.99 THEN LET d=8
  500 GO TO 220
  510 FOR a=0 TO 100: NEXT a: LET
le=le+1: NEXT e: LET h=h+h
  520 BORDER 1: PAPER 7: CLS: PR
INT AT 5,9; INK 0; FLASH 1;"WEL
L DONE!";AT 8,6;"BONUS ";250*l
e;" POINTS"
  530 LET s=s+250*le/4: RESTORE 6
0: FOR a=1 TO 21: READ b,c: IF b
=50 THEN PAUSE c: GO TO 550
  540 BEEP b,c+r
  550 NEXT a: PRINT #1; FLASH 1;"
 PRESS ANY KEY TO CONTINUE"
  555 IF INKEY$<>"" THEN GO TO 55
5
  557 IF INKEY$="" THEN GO TO 557
  560 GO TO 205
  1000 BORDER 0: PAPER 0: CLS: PR
INT AT 5,9; INK 2;"H"
  1015 PRINT INK 0;AT 10,0;"  PR
INT AT 0,10;"  ";AT 21,10;"  ";A
T 10,21;"  ";AT 10,21;"  ";AT 1
1,21;"  "
  1020 FOR a=0 TO 10 STEP 2: PRINT
 AT a,a;"  ";AT a,21-a;"  ": FOR b
=a+1 TO 9: PRINT AT a,b;"  ";AT
b,a;"  ";AT b,a;"  ";AT b,21-a;"
  ";NEXT b: NEXT a
  1040 PRINT AT 21-a,a;"  ";AT 21-a
,21-a;"  ": FOR b=10 TO 20-a: PRI
NT AT 21-a,b;"  ";AT 21-a,b;"  ";
AT b,a;"  ";AT b,21-a;"  ": NEXT
b: NEXT a
  1045 INK 7: PRINT AT 2,23;"LEVEL
";le
  1050 RETURN
  1100 PRINT AT y,x: FLASH 1; BRIG
HT 1; PAPER 6;"  ": IF USR
23807 THEN LET l=l-1
  1105 DATA -1,6,0,-1,0,-6,0,-5
,3,-1,3,-3,2,-3,0,-3,0,-1,1,0
  1110 LET d=d-1: GO TO 210
  1120 BORDER 2: PRINT INK 2;AT y,
x;"  ": RESTORE 1105: FOR a=1 TO
11: READ b,c: BEEP b,c+r: NEXT a
  1125 IF a>ti THEN LET h1=s: PRIN
T #1; FLASH 1; INK 7; PAPER 0;AT
 1,21;h1
  1130 BORDER 0: PRINT AT 17,23;"F
LASH 1;"PRESS ANY";AT 18,23;"KE
Y FOR ";AT 19,23;"ANOTHER";AT
20,23;"  GAME"
```

SOFTWARE *File*

Programs for Software File should be fairly compact and sent on a cassette. Please include clear instructions and say what computer it's for. We pay between £6 and £36 for programs published. They must be double-checked and submitted to *Your Computer* exclusively.

Dodgems

Julian Wood,
Downham Market,
Norfolk.

Spectrum

YOU CONTROL a white car running around a track of five lanes, trying to collect the yellow dots while avoiding the red computer-controlled car. Every so often the red car will drop a steering wheel — worth 50 points when collected. However, if you aren't quick enough, the red car will pick it up again. A dot is worth five points.

To make the game slightly more difficult, you have a limited amount of fuel. Once your fuel has run out, your car stops and it is only a matter of time before the red car crashes into you. When you crash you lose one of your three lives and when you have lost all your lives, a short tune is played, the game ends and you are invited to have another go. There is a high-score facility.

The amount of fuel changes from 500 to 400 to 300 units with each level completed. After three levels you receive a bonus number of points, the fuel returns to 500 units and the game becomes slightly harder. A level is completed when all the dots have been collected. At the beginning of each level, and also when you receive a bonus, the computer plays a short tune.

To enter Dodgems, first type in the Basic program in listing 1. Then enter a line 1 Rem followed by the letter "a" 384 times — or 12 lines' worth. This is used to hold the machine code. Then Run 9990 and carefully enter the decimal values in listing 2. In the left-hand column are the addresses and on the right-hand side, in brackets, are the addresses and on the right-hand side, in brackets, are the checksum values. If you make a mistake, enter −1 and enter that line again.

After entering a line of five numbers, check the checksum value before entering the next line. When you have finished entering the machine code and are sure that everything is correct, delete lines 9990-9995 and save the program using

SAVE "DODGEMS" LINE 15

When the program is run, there is a short pause while the user-defined graphics are set up and then the game starts. I moves your car in a lane, O moves it out a lane. You can move in or out up to two lanes at once, as can the red car.

The program uses four machine code subroutines:

23760—prints a certain number of dots used in setting up the display

23807—the explosion sound-effects routine

23848—moves the white car, and also decreases and prints amount of fuel

24011—moves the red car

The routines use two Rom subroutines:

8141—executes a #2, thus allowing printing in the upper half of the screen #n can also be achieved by: LD A,n: CALL 8143

6683—prints a decimal number in the range 0-9999.

Listing 2.

```
23760=205 205 31  14  0   (455)
23765=62  16  215 62  6   (616)
23770=215 6   21  62  152 (1252)
23775=215 62  16  251 62  16 (1336)
23780=215 175 215 62  22  (1521)
23785=215 121 215 62  18  (1341)
23790=215 62  32  215 62  (3730)
23795=215 215 62  11  215 (4207)
23800=12  62  21  155 32  (4579)
23805=215 201 6   10  32  (5344)
23810=0   0   126 211 254 (5635)
23815=35  124 254 64  32  (6144)
23820=247 16  242 201 229 (7279)
23825=213 68  77  33  0   (7470)
23830=0   17  32  0   25  (7544)
23835=16  253 9   1   0   (7823)
23840=88  9   126 209 225 (8480)
23845=254 4   203 211 6   (9262)
23850=75  92  1   74  0   (9444)
23855=221 9   221 78  25  (9998)
23860=221 70  26  11  221 (10547)
23865=113 25  221 94  2C  (11442)
23870=62  15  215 62  7   (11400)
23875=215 62  22  215 62  (11932)
23880=62  15  215 62  10  (12590)
23885=205 27  26  62  6   (12835)
23890=215 221 94  103 221 (13689)
23895=86  110 221 110 69  (14285)
23900=221 102 75  62  9   (14754)
23905=188 56  7   1   205 (15254)
23910=16  93  32  43  45  (15493)
23915=221 31  188 48  4   (15921)
23920=45  205 16  93  32  (16198)
23925=43  44  62  15  187 (16495)
23930=48  10  36  229 107 (16925)
23935=205 16  93  225 35  (17496)
23940=16  37  62  9   187 (17807)
23945=56  10  37  229 107 (18246)
23950=205 85  93  225 16  (18517)
23955=1   36  221 117 69  (19261)
23960=221 116 75  205 16  (19984)
23965=93  79  62  16  215 (20359)
23970=175 215 62  22  215 (20928)
23975=122 215 123 215 62  (21785)
23980=32  215 62  16  215 (22325)
23985=62  22  215 62  22  (22893)
23990=215 124 215 125 215 (23587)
23995=221 126 96  111 124 (24310)
24000=245 122 148 71  241 (25137)
24005=128 128 215 6   0   (25614)
```

(continued on next page)

(continued from previous page)

```
24010-201 205 205 31  221(26477)
24015-42  75  52  7   74 (26761)
24020-0   221 9   221 94 (27306)
24025-118 221 36  126 221(28073)
24030-110 82  221 103 89 (28682)
24035-62  9   188 56  7  (29004)
24040-45  205 38  188 56 (29359)
24045-43  44  52  11  190(29743)
24050-48  7   44  205 16 (30063)
24055-93  32  1   45  82 (30296)
24060-11  187 40  18  37 (30539)
24065-229 187 205 93  93 (31239)
24070-225 32  16  36  62 (31610)
24075-9   187 56  10  36 (31908)
24080-229 187 205 16  93 (32558)
24085-225 32  17  221 62 (33074)
24090-117 82  221 116 89 (33799)
24095-205 16  93  79  62 (34154)
24100-16  215 221 126 221(34769)
24105-245 215 62  22  215(35522)
24110-122 215 123 215 241(36438)
24115-254 5   62  182 32 (36943)
24120-1   62  157 215 62 (37441)
24125-16  215 62  215 123(37951)
24130-221 54  31  0   62 (38319)
24135-6   188 52  3   221(38766)
24140-113 31  195 180 93 (39378)
```

Carnival Shootout

Tony Loton,
Stoke-on-Trent,
Staffordshire.

Amstrad

CARNIVAL SHOOTOUT is an arcade-style game for the Amstrad CPC-464. It is about 6K long and is written partly in Basic and partly in machine code. Typing the data in wrongly could cause the program to crash so it is best to save the program on tape before running

```
10 ENV 1,15,1,1:ENT 1,15,1,1:ENV 2,15,-1,1:RESTORE
20 REM CARNIVAL
30 FOR I=38500 TO 38546:READ A:POKE I,A:NEXT
40 DATA 221 , 126 , 0 , 38 , 0 , 61 , 111 ,205 , 26 ,
188 , 6 , 8 , 125 , 50 , 44 , 151 , 124 , 50 , 45 , 15
1 , 126 , 84 , 93 , 35 , 197 , 1 , 79 , 0 , 237 , 176
, 193 , 43 , 119 , 58 , 45 , 151 , 103 , 58 , 44 , 151
, 111 , 205 , 38 , 188 , 16,222,201
50 FOR I=38400 TO 38451:READ A:POKE I,A:NEXT
60 DATA 221,126,0,38,0,61,111,205,26,188,6,8,125,50,44
,151,124,50,45,151,17,79,0,237,90,126,84,93,43,197 , 1
, 79 , 0 , 237 , 184 , 193 , 35 , 119 , 58 , 45 ,
151 , 103 , 58 , 44 , 151 , 111 , 205 , 38 , 188 , 1
6 , 217 , 201
70 FOR I=39000 TO 39073:READ A:POKE I,A:NEXT
80 DATA 17 , 64 , 156 , 221 , 110 , 0 , 221 , 35 , 2
21 , 102 , 0 , 237 , 90 , 68 , 77 , 197 , 221 , 35
, 221 , 110 , 0 , 221 , 35 , 221 , 102 , 0 , 17 , 0
, 0 , 205 , 29 , 188 , 193 , 221 , 35 , 221
90 DATA 94 , 0 , 221 , 35 , 221 , 86 , 0 , 237 , 90 ,
89 , 88 , 6 , 4 , 14 , 16 , 26 , 119 , 19 , 35 , 16 ,
250 , 6 , 4 , 43 , 43 , 43 , 43 , 205 , 38 , 188 , 13
, 62 , 0 , 185 , 194 , 139 , 152 , 201
100 SYMBOL AFTER 97:SYMBOL 97,0,0,48,88,248,184,4,28:S
YMBOL 98,28,28,14,7,61,88,36,8:SYMBOL 99,0,0,0,0,0,0,5
6,96:SYMBOL 100,96,96,112,120,0,0,0
110 SYMBOL 101,0,0,12,26,31,29,32,56:SYMBOL 102,56,56,
112,224,188,26,36,16:SYMBOL 103,0,0,0,0,0,0,28,6:SYMBO
L 104,6,6,14,30,0,0,0,0
120 SYMBOL 105,0,48,16,48,32,32,65,126:SYMBOL 106,127,
126,127,126,60,0,0,0:SYMBOL 107,0,128,64,64,120,0,0,0:
SYMBOL 108,0,0,0,0,0,8,8,24
130 FOR I=40000 TO 40063:READ A:POKE I,A:NEXT
140 DATA 0,48,0,0,0,16,0,0,0,16,0,0,0,16,0,0,0,16,0,0,
0,16,0,0,0,16,0,0,0,16,0,0,0,16,0,0,0,16,32,0
,0,16,16,0,0,16,16,0,0,48,16,0,0,48,48,16,16,48,48
150 FOR I=40064 TO 40127:READ A:POKE I,A:NEXT
160 DATA 0,0,0,0,0,0,0,0,80,0,0,0,80,0,0,0,80,0,0,0,240,160,0
,0,240,160,0,0,240,160,0,0,240,160,0,0,240,160,0,0,240
,160,0,0,240,160,0,0,240,160,0,0,80,0,0,0,80,0,0,0,240
,160,0,0,240,160,0
170 SCX=0:GOSUB 520
180 MODE 0:PAPER 0:CLS:INK 0,3:BORDER 3:INK 1,0:INK 2,
26:INK 3,20:INK 4,2:INK 5,0:INK 6,1:INK 7,24:INK 15,18
,9
190 SHX=0:FOR i=41000 TO 41063:POKE i,0:NEXT
200 SL=38500:SR=38400:SPRITE=39000
210 PEN 1:PRINT:PRINT:PRINT "a a a a a a a a a a b b
b b b b b b":PRINT CHR#(22)+CHR#(1):PEN 2:LOCATE 1,
3:PRINT"c c c c c c c c c c d d d d d d d d":PRINT
CHR#(22)+CHR#(0)
220 PEN 6:PRINT:PRINT " e e e e e e e e e e f f f f
f f f f":PRINT CHR#(22)+CHR#(1):LOCATE 1,7:PEN 2:PRI
NT" g g g g g g g g g h h h h h h h h h":PRINT CHR
#(22)+CHR#(0)
230 PEN 7:PRINT "i i i i i i i i i j j j j j j j j
j":PRINT CHR#(22)+CHR#(1):PEN 2:LOCATE 1,11:PRINT"k k
k k k k k k k l l l l l l l l l":PRINT CHR#(22)+C
HR#(0)
240 LOCATE 1,25:PEN 3:PRINT" CARNIVAL SHOOTOUT";
250 XX=40:PEN 15:BX=35
260 CALL SL,3:CALL SL,4:CALL SR,7:CALL SR,8:CALL SL,11
:CALL SL,12
270 IF INKEY(71)=0 AND F=0 AND XX>0 THEN GOSUB 330:XX=
XX-2
280 IF INKEY(63)=0 AND F=0 AND XX<72 THEN GOSUB 330:XX
=XX+2
290 IF INKEY(47)=0 AND F=0 THEN F=1:YX=7:BX%=XX:SOUND
2,0,0,15,2,0,10:BX=BX-1:LOCATE 9,1:PRINT BX:IF BX<0 TH
EN 440
300 CALL SPRITE,XX,23,0
310 IF F>0 THEN GOSUB 350
320 GOTO 260
330 CALL SPRITE,XX,23,1000
340 RETURN
350 YX=YX+32:IF YX>190 THEN F=0:CALL SPRITE,BX%,YX-32,
1000:RETURN
360 IF YX>39 THEN CALL SPRITE,BX%,YX-32,1000 ELSE CALL
 SPRITE,BX%,YX-16,1000
370 CALL SPRITE,BX%,YX,64
380 IF TEST(XX*8+14,YX*2+10)<>0 THEN 400
390 RETURN
400 CALL SPRITE,BX%-2,YX+16,1000:CALL SPRITE,BX%+2,YX+
16,1000:SHX=SHX+1:SCX=SCX+RND*10+10
410 SOUND 1,60,0,0,1,1:F=0:CALL SPRITE,XX,YX,1000
420 IF SHX>30 THEN 480
430 RETURN
440 CLS:PEN 1:PRINT "YOU RAN OUT OF      BULLETS."
450 PRINT:PRINT"YOU SCORED:";SCX
460 PRINT:PRINT" HIT ENTER TO PLAY"
470 IF INKEY(18)<>0 THEN 470 ELSE RUN
480 CLS:PEN 1:PRINT"YOU SHOT ALL THE     TARGETS 'WELL
DONE!"
490 PRINT:PRINT "YOU SCORED:";SCX
500 PRINT:PRINT "PRESS ENTER TO       CARRY ON."
510 IF INKEY(18)<>0 THEN 510 ELSE GOTO 180
520 MODE 1:PAPER 0:CLS:INK 0,3:BORDER 3:INK 1,0:INK 2,
26:INK 3,18:ENV 5,30,0,2,1,-15,1
530 PEN 1:PRINT "a a a a a a a a a a a a a a a a a a
 a b b b b b b b b b b b b b b b b b":PRINT CHR#
(22)+CHR#(1):PEN 2:LOCATE 1,1:PRINT"c c c c c c c c c
c c c c c c c c c c d d d d d d d d d d d d d d
d d d d":
540 PEN 3:PRINT "          CARNIVAL SHOOTOUT"
550 PEN 1:PRINT"e e e e e e e e e e e e e e e e e e e e
e f f f f f f f f f f f f f f f f f f":PEN 2:LOCAT
E 1,4:PRINT"g g g g g g g g g g g g g g g g g g g g g g
h h h h h h h h h h h h h h h h h h":
560 PRINT CHR#(22)+CHR#(0)
570 PEN 3:PRINT:PRINT"YOU HAVE TO SHOOT AS MANY OF THE
 MOVING TARGETS AS POSSIBLE. THERE ARE 30 TO HITAND YO
U ONLY HAVE 35 BULLETS SO AIM WITHCARE."
575 PRINT:PRINT "THE NUMBER OF BULLETS YOU HAVE LEFT I
S  SHOWN AT THE TOP OF THE SCREEN."
580 PEN 2:PRINT:PRINT "KEYS TO USE:-
                    Z-LEFT  X-RIGHT
              SPACE-SHOOT"
590 PAPER 1:PEN 0:PRINT:PRINT:PRINT:PRINT:PRINT:PRINT"
                 HIT ENTER TO START.                  "
600 SL=38500:SR=38400:RESTORE 640
610 CALL SL,1:CALL SL,2:CALL SR,4:CALL SR,5
620 READ N,D:IF N=-1 THEN RESTORE 640 ELSE SOUND 4,N,D
*6,15,5
630 IF INKEY(18)=0 THEN RESTORE:RETURN ELSE 610
640 DATA 95,4,106,4,119,4,106,4,95,8,106,2,119,2,127,2
,142,4,159,4,142,4,127,0,142,2,159,2,179,2,190,4,159,4
,119,4,127,4,106,4,80,4,95,16
650 DATA 95,4,106,4,119,4,106,4,95,8,106,2,119,2,127,2
,142,4,159,4,142,4,127,8,142,2,159,2,179,2,190,4,159,4
,119,4,127,4,106,4,80,4,119,16,-1,-1
```

Colours

A D Grundy,
Merton,
London.

Spectrum

THE PROGRAM sets out to prove that the Spectrum can show more than the usual eight colours. It does this by picking up the letter to be displayed and subtracting it byte by byte from the sprite graphic.

```
9002 LET k$="1234567": LET i$="6 per ";paper
600058: LET p$="1702332": FOR m 7000 REM show line l$
=1 TO 7
9004 LET high=VAL k$(m TO m): LE 7010 CLS : INK ink; PAPER paper
; ink=VAL i$(m TO m): LET papers LET l$=" Press 'Y' to show with i
LET p$(m TO m)                  nk;l$
9006 LET i=0: GO SUB 9400: GO SU 7020 GO SUB 7200
8 9500: PRINT INK ink; PAPER pap 7030 IF INKEY$="Y" OR INKEY$="y"
er; AT high,1;"A"; ink ";ink;" p THEN GO TO 7100
aper ";paper                    7040 GO SUB 7300: GO TO 7030
9008 NEXT m                     7050 REM ++show pink text++
6000 INPUT "If Colour ok press 'y                 ";y$: IF y$="y" OR y$="Y" THEN 7100 FOR d=1 TO 30 LET i=6+(d-3
LET ink=6: LET paper=1: GO TO 70 +CODE l$(d TO d)): GO SUB 9400
00                              GO SUB 9500: GO SUB 9600: PRINT
6010 INPUT "ink ";ink: INPUT "p& AT 10,d;"A";AT 11,d;"B": NEXT d
```

SOFTWARE File

```
GO TO 8800: REM
 show effect of filling in

7200 FOR d=1 TO 30: LET z=s+l-32
+CODE t$(f TO f+1): GO SUB 9400:
GO SUB 9500: PRINT AT 10,d;"A
T 11,d;"B": NEXT d: RETURN : REM

 show line of print

7300 FOR f=2 TO 30: BEEP .25,(IC
ODE t$(f TO f)/4): NEXT f: RETU
RN : REM make a noise

8800 REM ** BIG LETTERS **
8810 BORDER 1: FOR g=0 TO 10: IN
K RND*3: PAPER 7-RND*3
8820 INPUT " LETTER ";h$: LET z=
9+l-32+CODE h$
8825 GO SUB 9400
8830 GO SUB 9500
8840 GO SUB 9600
8850 FOR e=0 TO 21 STEP 2: PRINT
 AT e,0;"AAAAAAAAAAAAAAAAAAAAAAAA
AAAAAAAAA": AT 1+e,0;"BBBBBBBBBBB
BBBBBBBBBBBBBBBBBBBB"
8860 NEXT e: IF h$=" " THEN GO T
O 9000
8870 NEXT g
8880 GO TO 5000
9000 REM *big*
9400 FOR f=1 TO 7 STEP 2: POKE 6
5368+f,0: POKE 65368+8+f,0: NEXT
 f: RETURN : REM stripe Graphic
9500 FOR f=0 TO 7: POKE (65368+2
+f),255-PEEK (15616+(z)): NEXT f
: RETURN : REM get alpha-numeric
9600 FOR f=0 TO 7: POKE (65369+2
+f),0.5*PEEK (15616+f+(z)): NEXT f
: RETURN : REM half infill
```

Dominoes

J Ireland,
Canterbury,
Kent.

Vw-20

DOMINOES NEEDS a minimum 8K expansion. There are three variations on the game against the computer. All instructions are included with the game.

There are three versions. Block, Draw and Bergen. Each version has slightly different rules for scoring. In Block, or Draw you lose points for what is in your hand at the end. In Bergen you gain points for matching ends of chains.

```
READY.

10 PRINT"2" POKE26879,25
20 DIMPX(28,1):PY(28,1):CX(28,1):CPX(6)
30 A$="XXXXXXXXXX" C1$=" "
40 FL=4326 C0=33792 PR=PL+1 IL=-1 IR=-1 TP=PL-158
50 CL=0 CP=6 LL=0 RL=0 PA=0 LD=0 PD=0 SD=0 K1=-1 K2=K1
60 IFNOTHEN140
70 PRINT"XXXXXXXXXXXX BLOCK" PRINT"XXXXXXXXX DRAW" PRINT"XXXXXXXXX BERGEN"
80 PRINT"XXXXXXXXXXXX SELECT GAME"
90 GETA$ IFA$=""THEN90:"S"THEN200
100 G=VAL(A$):PRINT"XXXXXXXXXXXX INSTRUCTIONS? (Y/N)"
110 GETA$ IFA$=""THEN2410
120 IFA$="Y"THEN1410
130 PRINT"2"
140 DT=-50*(G=1)-100*(G=2)-15*(G=3) FT=-6*(G=3)-7*(G=2) CT=PT
150 IFNOTHEN170
160 ND=1 C=1 FORM=0TO6 FORB=RTO6 RX(C,0)=B RX(C,1)=B:C=C+1 NEXTB,M
169 REM ##SHUFFLE TILES##
170 FORJ=2TO2STEP-1
180 I=INT(RND(1)*(J-1))+1 A=RX(I,0) B=RX(I,1)
190 RX(I,0)=RX(J,0):RX(I,1)=RX(J,1) RX(J,0)=A RX(J,1)=B
200 NEXTJ
210 J=28 FORI=1TOPT:PX(I,0)=RX(J,0):PX(I,1)=RX(J,1) J=J-1
220 CX(I,0)=RX(J,0):CX(I,1)=RX(J,1) J=J-1 NEXTI BV=J
230 IFG=3THEN390
240 IFG=2THENPRINT"2"TB(9);"XXXBRAW" GOTO260
250 PRINT"2"TB(9)"XXXBLOCK"
260 IFDOTHEN360
270 PRINT"XXXBLL DRAW TO START" FORI=1TO2000 NEXT
280 A=INT(RND(1)*20)+1
290 B=INT(RND(1)*20)+1 IFA=BTHEN290
300 PRINT PRINT"I DREW A ";RX(A,0)";";RX(A,1)
310 PRINT:PRINT"YOU DREW A";RX(B,0)";";RX(B,1):PRINT
320 PRINT"YOU DREW A";RX(B,0)+RX(B,1) IFG2THEN340
330 PRINT"WE'LL HAVE TO REDRAW" FORI=1TO3000 NEXT PRINT"2" GOTO280
340 IFG1THENPRINT"I'LL START" WT=2 GOSUB680 GOSUB650 GOTO1530
350 PRINT"YOU START" WT=1 GOSUB680 GOSUB650 GOSUB770 GOTO670
360 PRINT"XXXXXXXXXX"
370 IFG1THENPRINT"YOU START," WT=1 GOSUB680 GOSUB650 GOSUB770 GOTO670
380 PRINT"I START," WT=2 GOSUB680 GOSUB650 GOTO1530
390 PRINT"2"TB(9)"XXXBERGEN"
400 PRINT"XXXBLOWEST DOUBLE STARTS" PRINT FORI=1TO2000 NEXT
410 C=7 FORI=1TOPT RA=PX(I,0) B=PX(I,1)
420 IFRA=BRAHCCTHENCHR P1=I
430 NEXTI
440 P=7 FORI=1TOCT A=CX(I,0) B=CX(I,1)
450 IFRA=BRAHHCDTHENCHR C=I
460 NEXTI
470 IFC=7THEN0=7THENPRINT"NO DOUBLE IN PLAY.....WE'LL START AGAIN"
480 IFC=7THEN0=7THENFORI=1TO2000 NEXT GOTO150
490 IFC=0THEN550
500 IFP=7THENPRINT"I HAVE NO DOUBLE" GOTO520
510 PRINT"I HAVE THE";CX(C1,0);",";CX(C1,1)
520 PRINT"YOU HAVE THE LOWEST  DOUBLE - THE";PX(P1,0);",";PX(P1,1)
530 PRINT"YOU START." WT=1 FKP=1 A=PX(P,0) B=A FORI=1TO3000 NEXT
540 GOSUB680 GOSUB650 GOSUB770 KP=1 GOTO670
550 IFC=7THENPRINT"YOU HAVE NO DOUBLE" GOTO570
560 PRINT"YOU HAVE THE";PX(P1,0);",";PX(P1,1)
570 PRINT"I HAVE THE LOWEST  DOUBLE - THE";CX(C1,0);",";CX(C1,1)
580 PRINT"I'LL START." WT=2 FK=1 A=CX(P,0) B=A FORI=1TO3000 NEXT
590 GOSUB680 GOSUB650 DLR=A GOSUB1280 LD=1 GOTO2000
600 REM ##SET UP PRIVING AREA##
610 FORI=1TO3000 NEXT PRINT"2" X=PL-10 POKEX,96 POKEX+21,96
620 FORY=0+22TO4+9*22STEP22 POKEY,96 POKEY+10,96 POKEY+21,96 NEXTY
630 PRINT"XCLIC1#AM SCORE ### TILES ";
640 RETURN
650 IFG>3RNDWT=1THENRETURN
660 GOSUB1200 RETURN
670 REM ##HUMAN PLAYER'S TURN##
680 POKE1990,0 PRINTI$IF: IFG=1OR:G=2RNDBY=2:OR(G=3RNDBY=0OR$E=1)>THEN700
690 PRINT"XXXPLAY OR SCORE?" GOTO710
700 PRINT"XXXPLAY OR SCORE?"
710 GETA$ IFA$=""THEN710 IFA$="P"RNDHA$="P"THEN710
720 IFA$="S"THEN750
730 GOSUB770 IFPT=0THEN2000
740 GOTO670
750 IFA$="S"THEN1040
760 GOTO1110
770 PRINTI$IF$"WHICH DOMINO?"
780 GETA$ IFA$="0"ORA$="6"THEN780
790 PRINTA$;"."
800 GETA$ IFA$<"0"ORA$>"6"THEN800
810 PRINTA$;"-"PRINTA$;"-" B=VAL(A$)
820 FORI=1TOPT:C=PX(I,0) D=PX(I,1) IF(C=HRNDD=D)OR(C=BRNDD=B)THEN850
830 NEXTIF PRINTI$IF$"YOU DON'T HAVE IT!" FORI=1TO2000 NEXT IFSD=0THEN670
840 RETURN
850 IFSD=0THENGOSUB1250 DRAW GOTO1810
860 IFA=DLORB=DRORB=DLORD=DRORD THEN920
870 PRINTI$IF$"THAT WON'T MATCH!" FORI=1TO2000 NEXT RETURN
880 IFC=0THEN1000 IFA=DLORB=DRORD:I=DRORD:I=DRORD THEN960
890 IFA=BRNDRDORLD:RNDDL=BRTHENDR0
900 IFA=BLRNDDR:OR(C=BLORD=DR)THEN920
910 GOTO960
920 PRINTI$IF"AT WHICH END (L OR R)?"
930 GETA$ IFA$="L"ORA$="R"THEN930
940 IFA$="L"THENPA=-B:D=BL:C=(C=BL):B=-B:C=BL:C=(C=BL) GOTO990
950 PA=-B:D=BR:C=(C=DR) B=-B:C=(C=BR):C=(B=DR) GOTO1000
960 IFA=DLTHEN920
970 IFA=DRTHEN1000
980 C=A B=B B=C IFA=DRTHEN1000
990 GOSUB1250 GOTO1010
1000 GOSUB1290
1010 FT=FT-1 FORJ=FTOPT PX(J,0)=PX(J+1,0) PX(J,1)=PX(J+1,1) NEXTJ
1020 IFSD=0RNDG=3RNDDL=DRTHENFS=FS+2 GOSUB2050 IFLDORBTHENFS=FS+1
1030 GOSUB1200 GOSUB1200 SD=SD+1 WT=2 RETURN
1040 IFBY=0THENPRINTI$IF$"NO TILES IN YARD." FORI=1TO3000 NEXT GOTO680
1050 IFBY=3RNDBE=1THENPRINTI$IF$"YOU CAN ONLY DRAW ONCE" FORI=1TO3000 NEXT GOTO68
0
1060 IFG=1THENPRINTI$IF$"NO DRAW IN THIS GAME." FORI=1TO3000 NEXT GOTO680
1070 IFG=2RNDBY=2THENPRINTI$IF$"THE YARD IS FROZEN." FORI=1TO3000 NEXT GOTO680
1080 BE=1 PT=PT+1 PX(PT,0)=RX(BY,0) PX(PT,1)=RX(BY,1) BY=BY-1
1090 K1=BL K2=DR
1100 GOSUB1170 GOSUB1200 GOTO680
1110 IFG=2RNDBY=2:OR(G=3RNDBY=0RNDBE=0)THEN1130
1120 GOTO1140
1130 PRINTI$IF$"YOU MUST DRAW!" FORI=1TO3000 NEXT GOTO680
1140 IFG=3RNDBY=0THEN1160
1150 PA=PA+1 IFPA=2THEN2080
1160 K1=BL K2=DR GOSUB1170 GOTO670
1170 PRINT"XXXCL$ PRINT"XXXTPS
1180 FORI=1TOPT SPC(4)CS PRINT"XXXSPC(10)PT PRINT"XXXSPC(4)CT PRINT"XXXSPC(18
)BY
1190 RETURN
1199 REM ##DISPLAY PLAYER'S TILES##
1200 PRINT"XXXXCL$"XXXXXXXXYOUR TILES" IFPT=0THENRETURN
1210 FORI=1TOPT-1
1220 J=-23*(I>7)RND(I>9)-44*(I>18) POKEPT+I*2+J,PX(I,0)+176 POKEPT+I*2+J+C0,0
1230 POKEPT+I*2+J+22,PX(I,1)+176 POKEPT+I*2+J+22+C0,0 NEXTI
1240 RETURN
1249 REM ##PUT TILE ON LEFT OF CHAIN##
1250 PRHD=LLRND IFA=BTHENLL=I
1260 IFLL=0THEN1350
1270 IFPEEK(PL)>96THENLL=I GOTO1340
1280 POKEPL,A+176 POKEPL+C0,C1 IFA=BTHENPOKEPL-22,B+176 POKEPL-22+C0,CL GOTO1310
1290 IFPEEK(PL+IL)>96THENPOKEPL+22,B+176 POKEPL+22+C0,CL PL=PL+44 LL=LL+2 GOTO1320
1300 PL=PL+IL POKEPL,B+176 POKEPL+C0,CL
1310 PL=PL+IL
1320 CL=-CL+C(CL+0)
1330 DL=B RETURN
1340 PL=PL+22-IL
1350 IFLL=2THEN1370
1360 POKEPL,A+176 POKEPL+C0,CL POKEPL+22,B+176 POKEPL+22+C0,CL PL=PL+44 LL=LL+1
GOTO1320
1370 IL=-IL PL=PL+IL-22 POKEPL,A+176 POKEPL+C0,CL PL=PL+IL POKEPL,B+176 POKEPL+C
0,CL
1380 LL=0 GOTO1310
1389 REM ##PUT TILE ON RIGHT OF CHAIN##
1390 PRHD=RD IFA=BTHENBR2=I
1400 IFRL=0THEN1490
1410 IFPEEK(PR)>96THENRL=I GOTO1450
1420 POKEPR,A+176 POKEPR+C0,CR IFA=BTHENPOKEPR-22,B+176 POKEPR-22+C0,CR GOTO1450
1430 IFPEEK(PR+IR)>96THENPOKEPR+22,B+176 POKEPR+22+C0,CR PR=PR+44 RL=2 GOTO1460
1440 PR=PR+IR POKEPR,B+176 POKEPR+C0,CR
1450 PR=PR+IR
1460 CR=-CR+C(R+0)
1470 DR=B RETURN
1480 PR=PR+22-IR
1490 IFRL=2THEN1510
1500 POKEPR,A+176 POKEPR+C0,CR POKEPR+22,B+176 POKEPR+22+C0,CR PR=PR+44 RL=RL+1
GOTO1450
1510 IFR=IR PR=PR+IR-22 POKEPR,A+176 POKEPR+C0,CR PR=PR+IR POKEPR,B+176 POKEPR+C
0,CR
1520 RL=0 GOTO1450
1529 REM ##COMPUTER'S TURN##
1530 PRINT"XX" IFSD=0THEN1570
1540 J=0 FORI=1TOCT:A=CX(F,0) B=CX(F,1)
1550 IFA=BTHENJ=J+1 IF
1560 NEXTI A=CX(J,0) B=CX(J,1) F=I DL=A GOSUB2040 GOSUB1390:GOTO2000
1570 FORI=0TO6 CPX(I)=0 NEXT FORJ=1TOCT:FORI=0TO6 CPX(I)=CPX(I)-(CX(J,0)=I)-(CX(
J,1)=I)
1580 NEXTI NEXTJ
1590 IFD>3ORSD>3THEN1690
1600 FORF=1TOCT A=CX(F,0) B=CX(F,1)
1610 IFA<>DLORB<>DRIRND(A<>DIFORB<>DL.THEN1660
1620 I=A+B:RND=RD:J=I+B:RND=DL:D=I:B=DL:RND=RD:J=A+B:RND=DL
1630 IFTHENONJGOTO1870.1880.1890.1900
1640 IFA=DLRND=DRTHEN1870
1650 IFA=BRND=BLTHEN1880
1660 NEXTF
1670 FORF=0TOCT:C=PTTHEN1920
1680 FORF=1TOCT A=CX(F,0) B=CX(F,1)
1690 IFA=3RND=BTHEN1740
1700 IFA=BRND:B=I:OR:B=2)THEN1800
1710 IFA=DLRND:B=I:OR:B=2)THEN1870
1720 IFA=DLRND:B=I:OR:B=2)THEN1870
1730 IFA=DRRND:B=I:OR:B=2)THEN1900
1740 NEXTF
1750 FORI=4TO1STEP-1 FORF=1TOCT A=CX(F,0) B=CX(F,1)
1760 IFA=3RNDB=BTHEN1790
1770 IFA=DLRND=DRRNDCP(B)>0)THEN1870
1780 IF:B=DLORB=DRRNDCP(B)>0)THEN1890
1790 NEXTF
1800 J=0 FORF=1TOCT A=CX(F,0) B=CX(F,1)
1810 IFA=3RNDB=BTHEN1840
1820 IFA=DLRND=B=DORB=DRRNDI=DL:THEN1870
1830 IF=B:J=RNDC=DLORB=DRORB:DLORB:B:THENJ=A+B I=F
1840 IFA=DLRND=B=DORB=DRCL(0,0) B=CX(I,1) F=I GOTO1870
1850 FORF=1TOCT A=CX(F,0) B=CX(F,1)
1860 IFA=3RNDB=BRNDCT(PT+3RNDBY=0THEN1910
1870 IFA.THENGOSUB2040 GOSUB1250 GOTO2000
1880 IFB=THENGOSUB2040 GOSUB1390 GOTO2000
1890 IFB=THENGOSUB2040 I=A A=B B=I GOSUB1250 GOTO2000
1900 IFB=THENGOSUB2040 I=A A=B B=I GOSUB1390 GOTO2000
1910 NEXTF
1920 IFG>3RNDBE=1:ORG=1OR:G=2RNDBY=2:OR$E=1)THEN1960
1930 PRINTI$IF$"XXI'LL HAVE TO DRAW." FORI=1TO2000 NEXT
1940 BE=1 CT=CT+1 CX(CT,0)=RX(BY,0) CX(CT,1)=RX(BY,1) BY=BY-1
1950 GOSUB1170 GOTO1570
1960 PRINTI$IF$"XXI'LL HAVE TO KNOCK." FORI=1TO3000 NEXT
1970 IFG=3RNDBY=0THEN1990
```

(continued on next page)

(continued from previous page)

```
1980 PA=PA+1 :IFPA=2THEN2080
1990 WT=1:GOTO678
2000 CT=CT-1 :FOR J=FTOCT:CX(J,0)=CX(J+1,0):CX(J,1)=CX(J+1,1):NEXTJ
2010 IFSD>0AND@=0AND@=0RTHENCS=CS+2 GOSUB2050 :IFLOOKPRTHENCS=CS+1
2020 GOSUB1170 SD=SD+1 WT=1 IFCT=0THEN2080
2030 GOTO678
2040 PRINTD1$D#"I'LL PLAY THE"R."B:FORI=1TO3000:NEXT:RETURN
2050 PRINTD1$D#: IFLOOKPRTHENPRINT"TRIPLE HERDER,"-GOTO2070
2060 PRINT"DOUBLE HERDER,"
2070 FORI=1TO2000:NEXT:RETURN
2079 REM ##END OF HAND##
2080 FORI=1TO1000:NEXT:PRINT"Z"
2090 GOSUB620 GOSUB1200:PRINT"W"
2100 IFG=3THEN2170
2110 GOSUB2370 PRINTD#"YOU HAVE"R"SPOTS".PRINT"I HAVE"B"SPOTS"W"
2120 IFA<BTHENPRINT"YOU WIN THE HAND" DG=1:GOTO2150
2130 IFA<BTHENPRINT"I WIN THE HAND" DG=2 GOTO2160
2140 PRINT"A DRAWN HAND," DG=0 GOTO2200
2150 PS=PS+B-A:GOTO2200
2160 CS=CS+A-B GOTO2200
2170 PRINTD$:IFPT>0THENPRINT"YOU GET ONE POINT FOR GOING OUT" PS=PS+1 DG=1 GOTO
2200
2180 IFPT=0THENPRINT"I GET ONE POINT FOR  GOING OUT" DG=2 CS=CS+1 GOTO2200
2190 PRINT"END OF HAND," DG=0
2200 GOSUB1170 IFPS:=CSORCS>50THENG240
2210 IFDG=1THEN2290
2220 IFDG=0THEN2310:A=A+1" GOTO2320
2230 GOTO2310
2240 IFPS<0THEN2280
2250 IFPS>0THEN2280
2260 IFDG=0THENA=A+"YOU" GOTO2320
2270 GOTO2310
2280 FORI=1TO6000 NEXT GOTO40
2290 A#="BUT I" GOTO2320
2300 A#="BUT YOU" GOTO2320
2310 A#="AND"
2320 IFPS<CSTHENPRINTD#"XXXXXXXX: DRAWN GAME." GOTO2340
2330 PRINTD#"XXXXXXXX"A#" WIN THE GAME."
2340 PRINT:PRINT"PRESS RETURN."
2350 DEFAN IFAN<2:CHR$(13)THEN2350
```

```
2360 RTN
2365 REM ##CALCULATE NO. OF SPOTS IN EACH PLAYER'S HAND##
2370 A=0 B=0 IFPT=0THEN2390
2380 FORI=1TOPT A=A+CX(I,0):B=B+CX(I,1):NEXTI
2390 IFCT=0THENRETURN
2400 FORI=1TOCT B=B+CX(I,0):A=A+CX(I,1):NEXTI RETURN
2410 PRINT"THE GAME OF DOMINOES IS PLAYED WITH A DECK OF 28 DOUBLE-ENDED"
2420 PRINT"TILES WITH PIPS OF  SPOTS AT EACH END FROM TO 6. PLAYERS ARE"
2430 PRINT"DEALT 6 OR 7 TILES  EACH, DEPENDING ON  WHICH GAME IS BEING"
2440 PRINT"PLAYED. THE REMAINDER GOING INTO A POOL.  CALLED THE YARD."
2450 PRINT" TILES ARE PLAYED TO  EITHER END OF A CHAIN UNTIL ONE PLAYER HAS"
2460 PRINT"USED ALL HIS TILES OR NEITHER PLAYER CAN GO."
2470 GOSUB2710
2480 ONGOTO2490:2530:2600
2490 PRINT" IN BLOCK GAME PLAYERSARE DEALT 7 TILES EACHAND THE GAME IS PLAYED";
2500 PRINT"TO 50 POINTS." PRINT" THE PLAYER WITH THE  HIGHEST DOUBLE STARTS"
2510 PRINT"AND PLAYS THAT TILE.  THERE IS NO DRAW FROM THE YARD."
2520 GOTO2670
2530 PRINT" IN DRAW GAME PLAYERS ARE DEALT 7 TILES EACHAND THE GAME IS PLAYED";
2540 PRINT"TO 100 POINTS." PRINT" PLAYERS DRAW TILES  FROM THE DECK TO"
2550 PRINT"DECIDE WHO STARTS.  PLAYING ANY TILE,"  HIGHEST NUMBER OF"
2560 PRINT"SPOTS STARTING AND
2570 PRINT" IF UNABLE TO PLAY THEPLAYER MUST DRAW FROM THE YARD UNTIL ABLE."
2580 PRINT"THE LAST 2 TILES IN  THE YARD CAN'T BE  DRAWN."
2590 GOTO2670
2600 PRINT" IN BERGEN PLAYERS AREDEALT 6 TILES EACH.  AND THE GAME IS PLAYED";
2610 PRINT"TO 15 POINTS." PRINT" THE PLAYER WITH THE  LOWEST DOUBLE STARTS"
2620 PRINT"AND PLAYS THAT TILE.  IF UNABLE TO PLAY THE PLAYER MUST DRAW FROM"
2630 PRINT"THE YARD. IF STILL  UNABLE TO PLAY THEN  PLAY PASSES TO HIS  OPP
ONENT."
2640 PRINT" POINTS ARE SCORED BY MATCHING ENDS OF THE  CHAIN. AN EXTRA POINT"
2650 PRINT"BEING SCORED IF ONE  END IS A DOUBLE."
2660 GOSUB2710 GOTO130
2670 GOSUB2710 PRINT" POINTS ARE SCORED AT END OF HAND BY THE  PLAYER WITH THE
 FEWEST"
2680 PRINT"TOTAL SPOTS ON HIS  REMAINING TILES.  SUBTRACTING HIS SPOTS"
2690 PRINT"FROM HIS OPPONENTS.  THE REMAINDER BEING"
2700 PRINT"THE SCORE FOR THAT  HAND." GOSUB2710 GOTO130
2710 PRINT"PRESS ANY KEY TO CONTINUE"
2720 GETA# IFA#=""THEN2720
2730 PRINT"Z" RETURN

READY.
```

Sound experimenter

Edward Upsdell,
Thonex,
Switzerland.

THIS PROGRAM is for an Atari with at least 32K of memory. It aims to help in understanding sound on the Atari and experiment with the sound.

Type in the program and run it. You should see something like figure 1.

To use sound register 0 type 0, hit Return, type REG, and hit Return. The rest is basically the same. Type in the number, hit Return, command, Return. This is used for the REG, FRE, DIS, VOL commands. Next is the FRC command. It does not have to be preceded by a number. Its function is to produce a click from the TV. A value of one in this place means on and a zero signal that it is off. The first eight lines, B7 to B0, are the bits in the AUDCTL register. To change bit seven to one, type B7, Return. To return it back to zero again, type B7, Return. These changes are technical and give no indication on what the sound will be like. It is best to experiment. Enough to say that using B0 through B4 turns on both sound channels associated with B7.

To hear the sound type in the register number, press Return, type in CH and hit Return again. It is possible is listen to all four channels at once. To turn off the sound type in Off and hit Return. The sound must be off to change one of the parameters. When you want to look at the sound statements to write them down for future reference, type in SDIS and hit Return. This will show the numbers for all four channels. When you use this sound in one of your own programs just type in the same numbers.

If any of the eight bits have a one beside them then in order to view the sound you must type in PDIS. This prints out the Poke statements for that sound. The SDIS command will not give you the full information. Again, when you went to use this sound, just copy the Poke statement into your program.

Figure 1.

```
AUDCTL (REG)ISTER 4
                 9 BIT POLY:(B7):0
        clock Ch.0 w/1.79 MHz:(B6):0
        clock Ch.2 w/1.79 MHz:(B5):0
           clock Ch.1 w/Ch.0:(B4):0
           clock Ch.3 w/Ch.2:(B3):0
        clock Ch.0 w/Ch.2HiP:(B2):0
        clock Ch.1 w/Ch.3HiP:(B1):0
                 15 kHz:(B0):0

 SOUND (REG)ISTER:
        (DIS)TORTION:
        (FRE)QUENCY:
           (VOL)UME:

X:
D: ?
USABLE COMMANDS:
REG DIS FRE FRC VOL OFF CH SDIS
PDIS
```

```
10 REM ********************
20 REM *SOUND EXPERIMENTER*
25 REM *      BY          *
30 REM *  EDWARD UPSDELL  *
40 REM *                  *
50 REM * COPYRIGHT(C)1984 *
60 REM ********************
80 DIM S(5,8),IN$(50),SP$(35)
85 SP$=
":REM 35 SPACES
90 FOR I=0 TO 8:FOR J=0 TO 5:S(J,I)=0:NEXT J
:NEXT I
100 REG=5000:DIS=5100:FRE=5200:FRC=5300:OFF=
5400
102 CLD=5900:CLX=6000:VOL=6100:POKAUD=6200:C
H=6300:START=6400:REGDIS=6500:BUZZ=6600
104 PDIS=6700:SDIS=6800:EDIS=6900
1002 GRAPHICS 0:POKE 752,1
1008 POSITION 2,0:? "AUDCTL (REG)ISTER 4"
1010 POSITION 2,1:? "                9 BIT POLY:(
B7):"
1020 POSITION 2,2:? "clock Ch.0 w/1.79 MHz:(
B6):"
1030 POSITION 2,3:? "clock Ch.2 w/1.79 MHz:(
B5):"
1040 POSITION 2,4:? "    clock Ch.1 w/Ch.0:(
B4):"
1050 POSITION 2,5:? "    clock Ch.3 w/Ch.2:(
B3):"
1060 POSITION 2,6:? "clock Ch.0 w/Ch.2 HiP:(
B2):"
1070 POSITION 2,7:? "clock Ch.1 w/Ch.3 HiP:(
B1):"
1080 POSITION 2,8:? "                 15 kHz:(
B0):"
1090 POSITION 2,9:? " SOUND (REG)ISTER:"
1100 POSITION 2,10:? "      (DIS)TORTION:"
1110 POSITION 2,11:? "      (FRE)QUENCY:"
1120 POSITION 2,12:? "      FORCE OUTPUT:"
1126 POSITION 2,13:? "         (VOL)UME:"
1128 POSITION 2,14:? "X:"
1130 POSITION 2,15:? "D:"
1140 POSITION 2,16:? "USABLE COMMANDS:";POSI
TION 2,17:? "REG DIS FRE FRC VOL OFF CH POIS
 SDIS"
1500 GOSUB START
2000 REM JUMP TABLE
2008 FOR ZZZ=1 TO 2 STEP 0
2010 POSITION 5,15:POKE 752,0:INPUT IN$:POKE
 752,1
2020 TRAP 2040:A=VAL(IN$):TRAP 40000
2030 POSITION 5,14:? A:GOSUB CLD
2040 IF IN$="REG" THEN GOSUB REG
2042 IF IN$="DIS" THEN GOSUB DIS
2044 IF IN$="FRE" THEN GOSUB FRE
2046 IF IN$="FRC" THEN GOSUB FRC
2048 IF IN$="OFF" THEN GOSUB OFF
2049 IF IN$="CH" THEN GOSUB CH
2058 IF IN$="VOL" THEN GOSUB VOL
2060 IF IN$="B7" THEN S(4,7)= NOT (S(4,7)):P
OSITION 30,1:? S(4,7):GOSUB CLD
2061 IF IN$="B6" THEN S(4,6)= NOT (S(4,6)):P
OSITION 30,2:? S(4,6):GOSUB CLD
2062 IF IN$="B5" THEN S(4,5)= NOT (S(4,5)):P
OSITION 30,3:? S(4,5):GOSUB CLD
2063 IF IN$="B4" THEN S(4,4)= NOT (S(4,4)):P
OSITION 30,4:? S(4,4):GOSUB CLD
2064 IF IN$="B3" THEN S(4,3)= NOT (S(4,3)):P
OSITION 30,5:? S(4,3):GOSUB CLD
2065 IF IN$="B2" THEN S(4,2)= NOT (S(4,2)):P
OSITION 30,6:? S(4,2):GOSUB CLD
2066 IF IN$="B1" THEN S(4,1)= NOT (S(4,1)):P
OSITION 30,7:? S(4,1):GOSUB CLD
2067 IF IN$="B0" THEN S(4,0)= NOT (S(4,0)):P
OSITION 30,8:? S(4,0):GOSUB CLD
2070 IF IN$="PDIS" THEN GOSUB PDIS
2072 IF IN$="SDIS" THEN GOSUB SDIS
2980 IF FAIL=1 THEN GOSUB BUZZ
2989 FAIL=0
2990 NEXT ZZZ
5000 REM REG
5010 IF A<0 OR A>3 THEN FAIL=1:GOTO 5088
5020 IF A>0 OR A<4 THEN POSITION 21,9:? A
5030 C=A
5040 GOSUB REGDIS
5088 GOSUB CLD:GOSUB CLX
5090 RETURN
5100 REM
5110 IF A<0 OR A>14 THEN FAIL=1:GOTO 5180
5112 IF INT(A/2)-A/2<>0 THEN FAIL=1:GOTO 518
0
5120 IF A=0 THEN D1=0
5121 IF A=2 THEN D1=32
5122 IF A=4 THEN D1=64
5123 IF A=6 THEN D1=96
5124 IF A=8 THEN D1=128
5125 IF A=10 THEN D1=160
5126 IF A=12 THEN D1=192
5127 IF A=14 THEN D1=224
5130 POSITION 21,10:? A
5140 S(C,1)=D1:S(C,5)=A
5170 S(C,8)=A
5180 GOSUB CLD:GOSUB CLX
5190 RETURN
5200 REM
5210 IF A<0 OR A>255 THEN FAIL=1
5218 POSITION 21,11:? "      "
5220 POSITION 21,11:? A
```

```
5230 S(C,2)=A
5280 GOSUB CLD:GOSUB CLX
5290 RETURN
5300 REM
5310 IF A=0 THEN S(0,3)= NOT S(0,3)
5320 IF A=1 THEN S(1,3)= NOT S(1,3)
5330 IF A=2 THEN S(2,3)= NOT S(2,3)
5340 IF A=3 THEN S(3,3)= NOT S(3,3)
5350 POSITION 21,12:? S(C,3)
5380 GOSUB CLD
5390 RETURN
5400 POKE 53761,0:POKE 53763,0:POKE 53765,0:
POKE 53767,0
5480 GOSUB CLD
5900 REM
5910 POSITION 5,15:? SP$(1,20)
5990 RETURN
6000 REM
6010 POSITION 5,14:? SP$(1,21):A=0
6090 RETURN
6100 REM
6110 IF A<0 OR A>15 THEN FAIL=1:GOTO 6180
6120 POSITION 21,13:? "          "
6122 POSITION 21,13:? A
6130 S(C,4)=A
6180 GOSUB CLD:GOSUB CLX
6190 RETURN
6200 REM
6208 SUM=0
6210 IF S(4,0)=1 THEN SUM=SUM+1
6211 IF S(4,1)=1 THEN SUM=SUM+2
6212 IF S(4,2)=1 THEN SUM=SUM+4
6213 IF S(4,3)=1 THEN SUM=SUM+8
6214 IF S(4,4)=1 THEN SUM=SUM+16
6215 IF S(4,5)=1 THEN SUM=SUM+32
6216 IF S(4,6)=1 THEN SUM=SUM+64
6217 IF S(4,7)=1 THEN SUM=SUM+128
6220 POKE 53768,SUM
6290 RETURN
6300 REM CH
6310 GOSUB POKAUD
6320 IF A=0 THEN POKE 53761,S(0,1)+S(0,4):PO
KE 53760,S(0,2)
6322 IF A=1 THEN POKE 53763,S(1,1)+S(1,4):PO
KE 53762,S(1,2)
6324 IF A=2 THEN POKE 53765,S(2,1)+S(2,4):PO
KE 53764,S(2,2)
6326 IF A=3 THEN POKE 53767,S(3,1)+S(3,4):PO
KE 53766,S(3,2)
6380 GOSUB CLX:GOSUB CLD:GOSUB REGDIS
6390 RETURN
6400 REM START
6410 FOR I=1 TO 8:POSITION 30,I:? "0":NEXT I
6490 RETURN
6500 REM REGDIS
6505 POSITION 21,12:? "   "
6506 POSITION 21,12:? S(C,3)
6507 POSITION 21,11:? "      "
6508 POSITION 21,11:? S(C,2)
6520 POSITION 21,10:? "      "
6521 POSITION 21,10
6522 IF S(C,1)=224 THEN ? "14"
6523 IF S(C,1)=192 THEN ? "12"
6524 IF S(C,1)=160 THEN ? "10"
6525 IF S(C,1)=128 THEN ? "8"
6526 IF S(C,1)=96 THEN ? "6"
6527 IF S(C,1)=64 THEN ? "4"
6528 IF S(C,1)=32 THEN ? "2"
6529 IF S(C,1)=0 THEN ? "0"
6530 POSITION 21,13:? "      "
6531 POSITION 21,13:? S(C,4)
6590 RETURN
6600 REM BUZZ
6610 ? CHR$(125):REM CLEAR SCREEN
6690 RETURN
6700 REM PDIS
6705 GOSUB EDIS
6710 POSITION 2,22:? "POKE 53768, ";SUM
6720 POSITION 20,18:? "POKE 53761, ";S(0,1)+
S(0,4):POSITION 2,18:? "POKE 53760, ";S(0,2)
6730 POSITION 20,19:? "POKE 53763, ";S(1,1)+
S(1,4):POSITION 2,19:? "POKE 53762, ";S(1,2)
6740 POSITION 20,20:? "POKE 53765, ";S(2,1)+
S(2,4):POSITION 2,20:? "POKE 53764, ";S(2,2)
6750 POSITION 20,21:? "POKE 53767, ";S(3,1)+
S(3,4):POSITION 2,21:? "POKE 53766, ";S(3,2)
6780 GOSUB CLD
6790 RETURN
6800 REM SDIS
6805 GOSUB EDIS
6810 POSITION 2,19:? "SOUND 0, ";S(0,2);", "
;S(0,3);", ";S(0,4)
6820 POSITION 2,20:? "SOUND 1, ";S(1,2);", "
;S(1,3);", ";S(1,4)
6830 POSITION 2,21:? "SOUND 2, ";S(2,2);", "
;S(2,3);", ";S(2,4)
6840 POSITION 2,22:? "SOUND 3, ";S(3,2);", "
;S(3,3);", ";S(3,4)
6880 GOSUB CLD
6890 RETURN
6900 POSITION 2,18:? SP$
6910 POSITION 2,19:? SP$
6920 POSITION 2,20:? SP$
6930 POSITION 2,21:? SP$
6940 POSITION 2,22:? SP$
6950 RETURN
9000 POSITION 2,18:? SP$
9010 POSITION 2,19:? SP$
9020 POSITION 2,20:? SP$
9030 POSITION 2,21:? SP$
9040 POSITION 2,22:? SP$
9050 RETURN
10000 END
```

Speedy commands

Brian Allan,
Scuntfield,
County Down.

Dragon

HERE ARE two routines for the Dragon. One of them lets you enter 52 commands by pressing two keys. The second one lets you change the speed of printing. First, I will show you how to use the single-key entry routine. Enter the listing. Save this then run it.

The routines are now activated. To use the single key entry option press the down arrow. The black cursor will change to a graphic character. To get a command press any letter — experiment for yourselves. 52 commands are available by using Shift. To enter the command

EDIT

press E. Edit should appear on the screen. You can put a line number after it. To enter a command like Point press P then the down arrow then J—Point will appear on the screen.

The print speed is held in locations 1022 and 1023. After the hex loader has finished enter

POKE 1022,20: LIST

You will see the program list slowly. The higher the value in 1022 and 1023 the slower the print speed. To switch off both routines enter

EXEC 32252

```
10 REM ******************
20 REM ** ONE KEY ENTRY **
30 REM ** & PRINT SPEED **
40 REM ** M/C. ROUTINE. **
50 REM ******************
60 REM **BY BRIAN ALLAN.**
70 REM ******************
80 CLEAR ?00,32224
90 CLS
100 PRINTTAB(9);"KEYWORD & PRINT"
110 PRINTTAB(9);"***************"
120 PRINT"please wait...LOADING THE HEX."
130 PRINT:PRINT"LOCATIONS."
140 PRINT:PRINT"'EXEC 32225' - ROUTINES ON.";PRINT "'E
XEC 32252' - ROUTINES OFF."
150 PRINT:PRINT "PEEK(1022)*256+PEEK(1023) IS THEPRINT
 DELAY."
160 PRINT:PRINT "FOR KEYWORD - PRESS THE DOWN    ARROW
 THEN A (SHIFT-LETTER) OR  (LETTER).52 COMMANDS AVAILA
BLE."
170 FOR AD=32225 TO 32767 STEP 10
180 CS=0
190 FOR Z=AD TO AD+9
200 READ H$:H=VAL("&H"+H$)
210 CS=CS+H
220 POKE Z,H
230 IF Z=32767 THEN 270
240 NEXT Z
250 READ CS$:SS=VAL("&H"+CS$)
260 IF SS<>CS THEN PRINT:PRINT "THERE IS AN ERROR IN L
INE";PEEK(49)*256+PEEK(50):END
270 NEXT AD
280 PRINT:PRINT:PRINT"ALL LOADED AND BOTH ROUTINES
ACTIVATED."
290 PRINT:PRINT
300 EXEC 32225
310 END
320 REM DATA FOR ROUTINES.
330 DATA B6,7E,B7,1,6A,B7,1,67,BE,7E,451
340 DATA 15,BF,1,6B,BE,7E,5,BF,1,68,379
350 DATA BE,0,0,BF,3,FE,39,86,39,B7,3FD
360 DATA 1,67,B7,1,6A,39,BF,3,FC,BE,43F
370 DATA 3,FE,30,1,30,1F,26,FC,BE,3,364
380 DATA FC,39,81,A,26,E2,C1,E6,22,DE,56F
390 DATA BF,3,F2,10,BF,3,F4,FD,3,F6,570
400 DATA 86,C9,10,9E,88,A7,A4,7F,1,19,499
410 DATA B0,B5,D,73,1,49,81,41,10,25,333
420 DATA 0,8A,81,7A,10,22,0,84,81,5B,317
430 DATA 25,6,81,60,22,2,20,7A,81,5B,2A6
440 DATA 25,2,80,6,80,40,BE,7E,D2,5F,3AA
450 DATA B7,3,F8,5C,F1,3,F8,27,8,A6,4CF
460 DATA 60,81,0,26,FA,20,F2,BF,3,F9,4EE
470 DATA 10,BE,3,F2,A6,80,81,0,27,7,398
480 DATA A7,A0,7C,3,F7,20,F3,10,BF,3,4A2
490 DATA F2,BE,3,F9,10,9E,88,A6,80,81,589
500 DATA 0,27,36,81,40,22,2,8B,40,A7,2B4
510 DATA A0,10,8C,5,FF,22,2,20,EA,10,37E
520 DATA BF,3,FB,10,BE,4,0,E6,A8,20,40D
530 DATA E7,A0,10,8C,5,E0,25,F5,C6,60,548
540 DATA E7,A0,10,8C,6,0,25,F8,10,BE,414
550 DATA 3,FB,31,AB,E0,20,C4,10,9F,88,4D2
560 DATA BE,3,F2,10,BE,3,F4,FC,3,F6,56D
570 DATA 39,41,55,44,49,4F,0,44,49,4D,285
580 DATA 0,43,4C,45,41,52,0,52,45,41,23F
590 DATA 44,0,45,5B,45,43,0,46,4F,52,250
600 DATA 0,47,4F,54,4F,0,50,52,49,4E,272
610 DATA 54,0,49,4E,50,55,54,0,4A,4F,27D
620 DATA 59,53,54,4B,28,0,43,49,52,43,294
630 DATA 4C,45,28,0,4C,49,53,54,0,53,248
640 DATA 4F,55,4E,44,0,54,48,45,4E,0,265
```

(continued on next page)

(continued from previous page)

```
650 DATA 4F,50,45,4E,0,50,4D,4F,44,45,2A7
660 DATA 0,44,52,41,57,0,52,45,54,55,26E
670 DATA 52,4E,0,53,43,52,45,45,4E,0,260
680 DATA 43,4C,4F,41,44,0,43,4C,53,0,245
690 DATA 53,45,54,28,0,53,54,45,50,0,250
700 DATA 4C,45,46,54,24,28,0,52,55,4E,26C
710 DATA 0,50,4F,4B,45,0,4D,4F,54,4F,26E
720 DATA 52,0,52,45,4D,0,43,4F,4C,4F,263
730 DATA 52,0,44,41,54,41,0,45,44,49,23E
740 DATA 54,0,4E,45,58,54,0,47,4F,53,27C
750 DATA 55,42,0,45,4C,53,45,0,49,4E,257
760 DATA 4B,45,59,24,0,50,4F,49,4E,54,297
770 DATA 28,0,50,41,49,4E,54,28,0,4C,21B
780 DATA 49,4E,45,0,41,4E,44,0,54,41,244
790 DATA 42,28,0,43,4C,4F,53,45,0,50,230
800 DATA 43,4F,50,59,0,43,4B,52,24,28,264
810 DATA 0,52,45,53,54,4F,52,45,0,53,277
820 DATA 54,52,49,4E,47,24,28,0,43,53,266
830 DATA 41,56,45,0,53,4B,49,50,4e,0,259
840 DATA 52,45,53,45,54,28,0,52,49,47,28D
850 DATA 48,54,24,28,0,4D,49,44,24,28,20E
860 DATA 0,52,45,4E,55,4D,0,50,45,45,261
870 DATA 4B,28,0,73
880 END
```

Sideways dump

M K Mostowyj,
Bretton Estate,
Peterborough.

Amstrad

THIS PROGRAM will produce a hard copy of any screen in any mode as long as the graphics origin is set to its default (0,0). The final printout is two tone only and assumes that the background colour is Paper 0.

The program is written in machine code. It is 202 bytes long and is located at &AAB3. Rather than having to use the Call statement to run the program, a new command is implemented via the resident system extention capability of the Amstrad.

To enter the program type in the basic listing and run it. If all is well you will be given the chance to save the code to tape.

To reload the code type:

MEMORY &AAB2:LOAD"",&AAB3

and press Return. Once loaded

CALL &AAB3

to log on the new command. If you are using a Paper other than 0 you may inform the routine with

POKE &AAF8,n

where n= the Paper being used. Please take note that it is Paper and not Ink.

Listing 1.

```
10 MODE 1
20 MEMORY &AAB2
30 SUM=0:RESTORE 170
40 FOR N=&AAB3 TO &AB7C
50 READ X$
60 POKE N,VAL("&"+X$)
70 SUM=SUM+VAL("&"+X$)
80 NEXT
90 IF SUM<>&5FA8 THEN SOUND 1,254,10:PRINT CLS:PRINT"
DATA WRONG PLEASE CHECK":END
100 CLS:PRINT"DATA LOADED CORRECTLY"
110 PRINT:PRINT"PLEASE INSERT TAPE FOR BYTES"
120 PRINT:PRINT"THEN PRESS ANY KEY"
130 IF INKEY$="" THEN 130
140 CLS:PRINT"SAVING DUMP,B:&AAB3,&CA"
150 SAVE "DUMP",B,&AAB3,&CA
160 END
170 DATA 01,c1,aa,21,bd,aa,cd,d1,bc,c9,00,00,00,00,c6,aa
180 DATA c3,d1,aa,44,55,4d,d0,00,00,00,00,00,00,cd,06
190 DATA b9,21,00,00,22,cb,aa,22,cd,aa,01,00,00,c5,3e,00
200 DATA 32,d0,aa,3c,32,cf,aa,06,07,c5,ed,5b,cb,aa,2a,cd
210 DATA aa,cd,df,bd,fe,00,28,0b,3a,cf,aa,47,3a,d0,aa,80
220 DATA 32,d0,aa,3a,cf,aa,a7,cb,17,32,cf,aa,2a,cb,aa,23
230 DATA 22,cb,aa,c1,10,d3,3e,1b,cd,73,ab,3e,4b,cd,73,ab
240 DATA 3e,00,cd,73,ab,3e,01,cd,73,ab,3a,d0,aa,cd,73,ab
250 DATA 2a,cb,aa,11,07,00,a7,ed,52,22,cb,aa,c1,03,78,fe
260 DATA 01,20,26,79,fe,91,20,21,3e,0a,cd,73,ab,2a,cb,aa
270 DATA 11,07,00,19,22,cb,aa,7c,fe,02,c2,dd,aa,7d,fe,84
280 DATA c2,dd,aa,3e,0f,cd,73,ab,c9,ed,43,cd,aa,c3,e0,aa
290 DATA c5,47,cd,2b,bd,78,30,fa,c1,c9
```

Listing 2.

```
AAB3  01 C1 AA 21 BD AA CD D1
AABB  BC C9 00 00 00 00 C6 AA
AAC3  C3 D1 AA 44 55 4D D0 00
AACB  00 00 00 00 00 00 CD 06
AAD3  B9 21 00 00 22 CB AA 22
AADB  CD AA 01 00 00 C5 3E 00
AAE3  32 D0 AA 3C 32 CF AA 06
AAEB  07 C5 ED 5B CB AA 2A CD
AAF3  AA CD DF BD FE 00 28 0B
AAFB  3A CF AA 47 3A D0 AA 80
AB03  32 D0 AA 3A CF AA A7 CB
AB0B  17 32 CF AA 2A CB AA 23
AB13  22 CB AA C1 10 D3 3E 1B
AB1B  CD 73 AB 3E 4B CD 73 AB
AB23  3E 00 CD 73 AB 3E 01 CD
AB2B  73 AB 3A D0 AA CD 73 AB
AB33  2A CB AA 11 07 00 A7 ED
AB3B  52 22 CB AA C1 03 78 FE
AB43  01 20 26 79 FE 91 20 21
AB4B  3E 0A CD 73 AB 2A CB AA
AB53  11 07 00 19 22 CB AA 7C
AB5B  FE 02 C2 DD AA 7D FE 84
AB63  C2 DD AA 3E 0F CD 73 AB
AB6B  C9 ED 43 CD AA C3 E0 AA
AB73  C5 47 CD 2B BD 78 30 FA
AB7B  C1 C9
```

Wild West

Anszar Zerfass,
Lehrberg,
West Germany.

Spectrum

THIS GAME uses the excellent Sprite routine by Robert Newman — *Your Computer* January, 1984, page 106 — to create smooth animated graphics in different colours. The programs will work on the 48K machine only. However, it may be changed for a 16K Spectrum by changing the Clear statement in line 10 to

CLEAR 31199

and by changing all Peek and Poke addresses except line 10. The new values for Peek, Poke and Rand USR statements can be calculated from the information in Newman's article.

The main program.

```
  3 REM  LINE 20 LOADS MACHINE
         CODE SPRITE ROUTINE BY
         R.NEWMAN - (YOUR COMPU-
         TER 1 84.PAGE 106

 10 POKE 23658,0: BORDER 0: PAP
ER 0: INK 7: INVERSE 0: OVER 0:
BRIGHT 0: FLASH 0: CLEAR 63999:
 15 PRINT AT 9,7; PAPER 6; INK
0; "LOADING ---- 80%": AT 1,
NT STOP THE TAPE YET!
4,0
 20 FOR F=1 TO 25: BEEP .005,F
NEXT F: LOAD ""CODE
 25 LET CU=0: LET PU=CU: GO TO
8000
 35 LET HI=0: LET CHI=HI: LET H
I1=HI: LET CHI1=CHI
 40 GO SUB 500
 45 RANDOMIZE USR 65145
 50 LET I$=INKEY$: IF PEEK 65520
7=0 THEN IF I$="P" OR I$="L" THE
N POKE 65203,(I$ = "L"): P
OKE 65204,5
 51 IF NOT UAG THEN IF RND<.95
THEN LET UAG=1: POKE 65260,120
POKE 65261,16: POKE 65267,255: P
OKE 65268,0: POKE 65269,4
 52 IF PEEK 65522=0 THEN POKE 6
5522,(-(4 AND RND)*5): POKE 6522
2,4
 54 IF I$="Q" THEN IF NOT SP TH
EN POKE 65230,139: POKE 65231,10
: POKE 65201,6: POKE 65237,254: PO
KE 65238,1: LET SP=1
 56 IF NOT SP THEN IF RND<.1 TH
EN POKE 65234,52: POKE 65246,108
: POKE 65216,6: POKE 65252,254: POK
E 65253,1: LET SP=1
 58 IF SP THEN IF PEEK 65230=0
THEN POKE 65230,0: POKE 65231,0:
POKE 65201,0: POKE 65237,0: POKE
0,0: LET SP=0
 60 IF SP THEN IF PEEK 65239=12
: THEN GO SUB 70
 62 IF SP THEN IF PEEK 65245=25
6 THEN POKE 65245,0: POKE 65254,
: PRINT AT 21,11; INT (PEEK 65246/8
0); " ": LET SP=0
 64 IF SP THEN IF PEEK 65254=12
8 THEN GO SUB 70: IF SP THEN IF
PEEK 65239=128 THEN GO SUB 70
 65 IF CHI<>CHI1 OR HI<>HI1 THE
N LET CHI1=CHI: LET HI1=HI: GO T
```

SOFTWARE File

```
0 40+(120 AND (CHI=3 OR HI=3))
 65 GO TO 50
 70 LET SP=0: POKE 65235,0 POK
E 65239,0: IF PEEK 65230<62 AND
PEEK 65230>50 THEN GO TO 100
 71 IF PEEK 65230<132 AND PEEK
65230>120 THEN POKE 65269,0: LET
 UAG=0: LET CY=15: LET CX=21-INT
(PEEK 65261/8): FOR F=5 TO 0 STE
EP -1: PRINT AT CX,CY; INK 2+(F
8=INT (F/2)); "CD"; AT CX+1,CY;"EF
": BEEP .005,F: NEXT F: PRINT AT
 CX,CY;" ": AT CX+1,CY;" ": AT C
X+2,CY;" ": RETURN
 72 LET CY=INT (PEEK 65230/8)
LET CX=21-INT (PEEK 65231/8): PR
INT AT CX,CY; INK 6; FLASH 1;"A":
 BEEP .005,0: PRINT AT CX,CY;" "
: RETURN
 75 LET SC=0: POKE 65253,0: POK
E 65254,0: IF PEEK 65245<195 AND
PEEK 65245>212 THEN GO TO 110
 76 IF PEEK 65245<132 AND PEEK
65245>117 THEN POKE 65269,0: LET
 UAG=0: LET CY=15: LET CX=21-INT
(PEEK 65261/8): FOR F=5 TO 0 STE
EP -1: PRINT AT CX,CY; INK 2+(F
8=INT (F/2)); "CD"; AT CX+1,CY;"EF
": BEEP .005,F: NEXT F: PRINT AT
 CX,CY;" ": AT CX+1,CY-1;" ":
 AT CX+2,CY-1;" ": RETURN
 77 LET CX=21-INT (PEEK 65246/8
): LET CY=INT (PEEK 65245/8): PR
INT AT CX,CY; INK 6; FLASH 1;"A":
 BEEP .005,0: PRINT AT CX,CY-1;"
": RETURN
 100 FOR F=0 TO 255 STEP 5: BEEP
.01,F: OUT 254,F: NEXT F: LE
T CHI=CHI+1: GO SUB 150
 105 RETURN
 110 FOR F=255 TO 0 STEP -5: BEE
P .01,F: OUT 254,F: NEXT F: L
ET HI=HI+1: GO SUB 150
 115 RETURN
 150 LET $$= HI*$+:+STR$ CHI+
--: UILD WEST --: HI*$+:+STR$ HI+
--: INPUT "": PRINT #0; PAPER 5
: INK 1;$: RETURN
 160 IF CHI=3 AND HI=3 THEN LET
S$= --- BOTH HAVE BEEN KILLED -
--: GO TO 200
 170 IF CHI=3 THEN LET P$=P$+1:
LET S$= --- YOU HAVE SURVIVED
--: GO TO 200
 180 IF HI=3 THEN LET C$=C$+1: L
ET S$= --- YOU HAVE BEEN KILLE
D ---
 200 RANDOMIZE USR 65155: PRINT
AT 4,0; BRIGHT 1; PAPER 5; INK 0
;S$
 210 LET S$= "SCORE: SLIM JOEY -
+STR$ C$+" - YOU "+STR$ P$
 220 IF LEN S$>32 THEN LET S$=S$
(TO 32): GO TO 230
 230 PRINT AT 20,0; PAPER 7; INK
1;S$
 240 INPUT "": PRINT #0; INK 0;"
Another game (Press 'Y' or 'N') ?
": BEEP .5,-12
 250 IF INKEY$="Y" THEN CLS: GO
TO 270
 260 IF INKEY$="N" THEN GO TO 99
9
 270 GO TO 250
 500 RANDOMIZE USR 65155
 505 BORDER 6: PAPER 6: INK 0: C
LS: GO SUB 650
 510 FOR F=65208 TO 65313 STEP 1
5: POKE F,0: NEXT F
 515 RANDOMIZE: RESTORE 520: FO
R F=65200 TO 65271: READ G: POKE
F,G: NEXT F
 520 DATA 200,INT (RND*140)+25,0
,0,0,0,0,0,0,250,0,11,15
 530 DATA 0,0,0,0,0,0,0,0,0,0,0,
0,2,4,0,0,0,1,0,32,250,0,11,15
 540 DATA 128,0,-5,0,1,0,0,254,0
,0,64,254,0,0,0,0,0,0,0,0,0,0,0,
 550 DATA 62,0,4,0,1,0,0,254,0,0
,64,254,0,0,0,0,0,0,0,0,0,0,0,0,
 560 DATA 0,0,0,0,0,1,4,2,0,255,0,0,
 570 LET SC=0: LET SP=0: LET UAG
=0
 580 RANDOMIZE: FOR F=1 TO 4: F
OR G=1 TO INT (RND*6)+6: PRINT A
T INT (RND*22); INK INT (RND*4)+1;A
T INT (RND*22); INK INT (RND*4)+1;A
T INT (RND*22); INK INT (RND*4)+1;
(127 AND F=4); INK 4;CHR$ (144+(R
ND);$); NEXT G: NEXT F
 590 FOR F=0 TO 21: PRINT AT F,6
: INK 2; AT F,25; INK 2: NEXT F
: NEXT F
 600 RETURN
 800 BORDER 1: PAPER 5: INK 1: B
RIGHT 1: CLS
 810 PRINT AT 1,7; BRIGHT 0; PAP
ER 7; "--- WILD WEST ---"
 820 PRINT AT 3,0;" Here you are
 again - a lone cowboy facin
g death under the hot sun burn
ing down on the wide desert.

 830 PRINT "" No one there to he
lp you - you're on your own
```

The game Wild West allows one player to take part in a deadly gunfight. Full instructions are included in the program. It is you against Slim Joey, who is controlled by the computer. Joey will be able to move faster than you — especially on the higher levels — so he's a really tough opponent. Some extra features are cacti spread all over the scenario — a desert — and a covered wagon which will appear at random and will explode if hit by a bullet.

Type in the program carefully and save it on tape with

SAVE "wild west" LINE 1

Load the 48K Sprite routine, and save it immediately behind the main program with

SAVE "spmov48k" CODE 64551,611

Verify the recordings and try to run the program. Check all Peek/Poke/Rand USR statements and the sprite data hold in lines 520-560 and 1050-1070 — graphics — if the game does not work properly.

A lot of work may be saved by editing similar lines and changing the small differences — e.g. 70-72 and 75-77.

Program structure.

1-25	Set-up
50-86	Main loop
70-72	Subroutine: Player's bullet hit
75-77	Subroutine: Joey's bullet hit
100-110	Subroutine: Player/Joey hit
150	Subroutine: Print score
160-270	End of game
500-600	Subroutine: Set up screen and Poke initial values for sprites
800-900	Instructions and selection of skill level
1000-1070	Subroutines: Set up user-defined graphics (1000-1030) and sprite graphics (1040-1070)

```
 ag:ins'          ouim Joey, whose n
ame is           feared throughout
the west."
 835 PRINT "" He moves faster, h
is bullet is     faster - so good l
uck, boy!
 840 PRINT "" You will only surv
ive 2 hits.      And you cannot mov
e once Joey      has been hit, his
bullet may       hit you in the nea
r time.
 850 GO SUB 1000: PRINT #0; PAPE
R 6; INK 0;"                 PRESS ANY K
EY": BEEP 1,-10: PAUSE
0: CLS
 860 PRINT "" The cacti and cove
red wagons       will gain you no b
onus points.     It is just him or
you.
 870 PRINT "" Move by pressing
'A' for L        (up/down) and put
t the trigger    by pressing key 0
.
 880 PRINT AT 19,0;" Press key 1
-8 to select game      level (1-6,
6=hard)": BEEP 1,-12
 890 LET I$=INKEY$: IF I$="1" OR
I$="6" THEN GO TO 890
 900 LET LEV=VAL I$: BRIGHT 0: G
O TO 50
 1000 RESTORE 1000: FOR F=USR "A"
 TO USR "F"+7: READ G: POKE F,G:
 NEXT F
 1010 DATA 16,144,146,146,242,18,
30,16,16,16,146,146,158,240,1
6
 1020 DATA 2,17,9,5,37,21,108,44,
0,4,72,80,36,168,176
 1030 DATA 36,21,138,74,36,27,7,7
,178,164,168,178,32,252,128,192
 1040 FOR F=64000 TO 64064: READ
G: POKE F,G: NEXT F
 1050 DATA 7,0,15,128,15,0,9,0,5,0
,2,0,199,224,63,160,15,160,15,64
,15,128,7,128,5,0,5,0,11,0,0,0,0
,0,62,0,20,0,16,0,20,0,8,0,252,
96,191,128,190,0,94,0,62,0,60,0,
20,0,20,0,20,0,224
 1060 FOR F=64096 TO 64127: READ
G: POKE F,G: NEXT F: RETURN
 1070 DATA 15,0,16,128,96,96,192,
48,192,48,192,48,192,48,192,48,1
92,48,192,48,64,32,63,192,15,0,1
59,144,255,240,128,16
 9950 CLS: PRINT AT 10,8;"© A.ZE
RFASS 1984"
```

The hex loader.

```
 10 DEF FN h(h$)=16*(CODE h$(1)
-48-(7 AND h$(1)>"9"))+CODE h$(2
)-48-(7 AND h$(2)>"9")
 20 INPUT "Start ";s
 30 INPUT "Finish ";f
 40 FOR n=s TO f STEP 8
 50 LET tot=0: PRINT n;" ";
 60 INPUT h$: PRINT h$;
 70 LET x=0
 80 FOR b=1 TO LEN h$ STEP 2
 90 LET z=FN h(h$): LET tot=tot
+z
 100 POKE n+x,z
 110 LET h$=h$(3 TO ): LET x=x+1
 120 NEXT b
 130 PRINT " = ";: INPUT t: PRIN
T t
 140 IF tot<>t THEN PRINT "input
error - try again": GO TO 50
 150 NEXT n
 160 REM enter STOP to stop
```

The machine code.

```
64551  2A94FE22A0FE38BE  = 1059
64559  FE22A0FE2D4BCECD  = 1217
64567  FE22A0FE2D4BCECD  = 1125
64575  3613AF3AAAFE3A9C  = 901
64583  FEAAAOFEE6A35E23  = 960
64591  AAAOFEED4B9CFECD  = 1375
64599  FE22A0FE22A0FEED  = 1163
64607  2FE5D73C22A0FE32  = 885
64615  9FFED5B61A2A9CFE  = 1245
64623  D5B61A2A9CFEED5  = 1167
64631  4B9CFEED5B61A2A  = 1167
64639  9AFED5B61A8CDAA  = 1083
64647  A2AECCDFEC3A9CFE  = 1243
64655  5B0B3A9CFEED4B9C  = 1134
64663  FEED5B61A2A9CFED  = 1163
64671  9BFE3A9FFE3A9AFE  = 1358
64679  DD36F004ECDC3FE  = 1020
64687  DD36F10C0D8103A4  = 910
64695  AA9FFE3A9FFE3A9  = 967
64703  013D20FB3A9BFEFE  = 1066
64711  00283EFE0A01E7A  = 530
64719  DDCB1A4A8D04AFA1  = 762
64727  1DDCB1A4ACDFFDE1  = 1125
64735  4FE3371C9CB23CB12  = 935
64743  3B0AC8D11B0FDDCB  = 727
64751  4B4B2B0C8D11DDCD  = 594
64759  FD1B0DCB21D2BE1  = 834
64767  3AAAFEFE0D2B0CB  = 965
64775  013D20FB71C9DDCB  = 1053
64783  09FEC9DDCB69DDD  = 969
64791  CB02FE2A1C3AAAFE  = 862
64799  FE00283FDDFE0028  = 805
64807  1C3D3D1B1B3A8AFE  = 630
64815  FD5B0D3A9FEF3AA3  = 1051
64823  FD5B0D3A9FEF3AA3  = 1206
64831  DDBE14381EDDCB03  = 944
64839  7E2B003AA4FEFEAF  = 1071
64847  3D3D2B3AA4FEDD9E  = 1150
64855  3D3D2B3AA4FCFED02  = 1050
64863  3D30CDDCB09CEDD  = 1149
64871  CB05462D3BAFDDCB  = 1125
64879  02FE2A0FDDCB09  = 863
64887  2B3AA4FEFEDD9E  = 1050
64895  2006AF3291FE18ED  = 875
64903  3A8CFEED4A22B0FE  = 1201
64911  1B8DDCB05B9CFDDCB  = 1128
64919  05B3DDCB05B9CFDDCB  = 804
64927  037E2B3D53EFFDD86  = 846
64935  0E5B2AAFEDDCB054E  = 989
64943  8DDCB3228FE3A9CF  = 920
64951  2B3A9CFE3A9CFED5B  = 1129
64959  3A4FEFEED5B3CE50  = 1400
64967  DDCB0037E2B0D2B60  = 889
64975  DDCB0037E2B0D2B60  = 1129
64983  0FD0D5D3E5D5EEEE  = 1000
64991  DDE1DDCB08A62DDB  = 991
64999  DDCB0CFEE1D1C1E1  = 1348
65007  DDCDDCDDCDDCDDCD  = 1195
65015  2BCD5BFEDDCB0E1801  = 1195
65023  CD27FDCDDCB097E28  = 1095
65031  DDCB0B06A5E2D04DD  = 767
65039  DDCB0B06A5E2D04DD  = 1171
65047  FED0DEE1D1C1D5E5  = 1711
65055  EDB01B3BDD2B50220  = 955
65063  CDDD7E037FE0D28C9  = 1044
65071  FED0DDCDDE1D1D1D1  = 1038
65079  15DFE38AFEDDB6D2  = 1154
65087  3AD3FE3A8FEDDB6  = 1273
65095  0328AFEDDB2D3B1800  = 770
65103  CD27FE0D2FE0D2FE  = 1177
65111  FEE28AFE189EE118A  = 1017
65119  FED10D00C5DDE1ED  = 1166
65127  BDC9F3F5D5E5EDD  = 1729
65135  FED0DDCDDE1D1D1  = 1778
65143  01F1C33B00C5EDDED  = 993
65151  47BD5EC93E3EED56  = 1050
65159  ED47C9D0  = 509
```

Graphics 7 Paintbox

Christopher Jones,
Herne Bay,
Kent.

Atari

THIS PROGRAM allows the user to draw a picture on a Graphics screen. These pictures may be stored on cassette for retrieval at a later time, so that finished pictures may be viewed again and again or unfinished pictures completed. A number of paint programs are now on the Atari market, but my program allows the user to sample the possibilities of this type of program without parting with any cash!

One of the main considerations while writing this program was to keep it as user-friendly as possible. There are on-screen prompts at all times, and all options are performed in a similar way. In addition to the joystick only the number keys are used to carry out instructions. Although the Atari computer has a vast range of colours to display, I have deliberately kept the choice down to a simple minimum.

The colours are also named — rather than using a combination of hue and luminance — which means that children of reading age should be able to use the program. If anyone is not satisfied with my choice of colours they are easily changed: lines 3000-5000 contain the relevant routines.

When you have typed in the program save it on a cassette and then run it. The screen will show a menu of options:

SCREEN — First select the screen colour of your choice.

PALETTE — Next select three colours with which you wish to draw your picture.

COLOUR — This command allows you to choose a working colour from your palette. This colour will then be used when you select draw, circle, etc.

DRAW — A cursor will appear in the centre of the screen in the colour you have chosen. Move the cursor by pushing the joystick in the required direction. If you wish to draw then keep the joystick button depressed and move the joystick in the required direction. To plot a point — useful for stars — simply fire the button once and move on.

DRAWTO — A cursor will appear in the centre of the screen. Move the cursor to one end of the line you wish to draw and hit any key. Then move the cursor to the other end and hit any key. A line will be drawn between the two points.

ERASE — When the cursor appears move it to the area you wish to erase. Hold the joystick button down and move over the points and lines you wish to erase.

CIRCLE — Move the cursor to the point where you wish the circle's centre to be and hit any key. Then move the cursor left or right to establish the radius of the circle and hit any key.

FILL — Move the cursor to the area you wish to fill and hit any key. The area must be enclosed and must be filled with the same colour with which it was drawn. Awkward shapes may need more than one fill.

SAVE — Put a blank tape in the casette unit. When you hear two beeps press play and record, then hit return.

LOAD — Put the tape on which you saved the picture in the cassette unit. When you hear a beep press play, then hit return.

Choose your screen colour carefully. It need not be merely a background, but an integral part of the picture e.g. a grey screen colour could be used for the surface of the moon.

If you wish to erase part of a filled in area select a working colour which will show up against that area and then select erase. When the picture is finished try putting a frame around it by using draw or drawto.

Screen colours and palette colours can be changed at any time, often with interesting results. Experimentation is the best approach in this respect, so don't be shy!

If the program should stop for any reason — such as a misuse of Fill — then type Goto 1000 and you will be able to continue work on that picture.

The circle routine in my program is based on the one in Ian Sinclair's *Boots Guide to the Atari 600XL*. I have adapted it to plot a continuous line as the circumference of the circle, because any gaps would interfere with the smooth running of the fill routine. In my version it is also possible to have semicircles and arcs at the edges of the screen.

The display list interrupt routine which protects the colours in the text window is based on the one in Peter Budgell's article on Graphics 10/7 in *Analog 14*. I have altered it to fit in with the colour requirement of my program.

```
1 REM GRAPHICS 7 PAINTBOX
2 REM CHRISTOPHER P. JONES
3 REM APRIL 1984
9 REM INITIALISE
10 OPEN #1,4,0,"K:"
20 GRAPHICS 7
25 DIM A$(10),C1$(10),C2$(10),C3$(10),R(
3,2)
35 R(1,1)=0:R(1,2)=0:R(2,1)=0:R(2,2)=0:R
(3,1)=9:R(3,2)=14
36 GOSUB 11000
37 POKE 752,1
38 SETCOLOR 4,8,8:POKE 54286,192
40 GOTO 1000
199 REM MAIN LOOP
200 X=80:Y=40
205 X1=X:Y1=Y:COLOR C:PLOT X,Y
250 GOSUB 800
255 IF PEEK(764)<255 THEN 2500
265 IF S=15 AND FLAG=0 THEN 350
270 IF FLAG=0 THEN 350
280 COLOR B
290 PLOT X1,Y1
295 LOCATE X,Y,B
300 GOTO 205
350 IF ERASE=1 THEN COLOR 0:PLOT X1,Y1
360 GOTO 295
399 REM FILL
400 Y2=Y:X2=X:COLOR C
405 Y2=Y2-1:LOCATE X2,Y2,C1
410 IF C1<>C THEN 405
415 Y3=Y
420 Y3=Y3+1:LOCATE X2,Y3,C1
425 IF C1<>C THEN 420
450 K=Y3-Y2
460 FOR L=1 TO K:X2=X
465 LOCATE X2,Y2+L,C1
470 IF C1=C THEN 500
480 PLOT X2,Y2+L
485 X2=X2-1
490 GOTO 465
500 X2=X+1
505 LOCATE X2,Y2+L,C1
510 IF C1=C THEN 530
515 PLOT X2,Y2+L:X2=X2+1
520 GOTO 505
530 NEXT L
535 POKE 764,255
550 GOTO 1000
599 REM CIRCLE
600 IF Q=1 THEN 610
601 Q=1:D=B:COLOR C:PLOT X,Y:X2=X:Y2=Y:P
OKE 764,255:GOTO 295
610 Q=0
620 R=X-X2:COLOR C
640 FOR N=0 TO 360
645 Z=X2+R*SIN(N)
646 IF Z<0 OR Z>159 THEN 660
647 Q=Y2+R*COS(N)
648 IF Q<0 OR Q>79 THEN 660
650 PLOT Z,Q
660 NEXT N
665 COLOR D:PLOT X2,Y2
680 GOTO 1000
800 REM JOYSTICK INPUT
810 S=STICK(0)
815 T=STRIG(0):FLAG=SGN(T)
825 IF S=10 OR S=11 OR S=9 THEN X=X-1
830 IF S=6 OR S=7 OR S=5 THEN X=X+1
835 IF S=10 OR S=14 OR S=6 THEN Y=Y-1
840 IF S=13 OR S=5 OR S=9 THEN Y=Y+1
845 IF X<0 THEN X=0
850 IF Y<0 THEN Y=0
855 IF X>159 THEN X=159
860 IF Y>79 THEN Y=79
895 RETURN
899 REM DRAWTO
900 IF Q=1 THEN 910
901 COLOR C:PLOT X,Y
905 Q=1
906 X2=X:Y2=Y
907 POKE 764,255:GOTO 295
910 X3=X:Y3=Y
911 COLOR C
915 PLOT X3,Y3:DRAWTO X2,Y2
920 POKE 764,255:Q=0:GOTO 1000
999 REM MAIN MENU
1000 ? "}"
1001 FOR K=1 TO 3:SETCOLOR K-1,R(K,1),R(
K,2):NEXT K
1005 POKE 764,255
1010 ? "DRAW(1),DRAWTO(2),ERASE(3),CIRCL
E(4), FILL(5),SCREEN(6),COLOUR(7),PALETT
E(8)SAVE(9),LOAD(0)?";
1015 ERASE=0:LOCATE 80,40,B
1018 FILL=0:DRAW=0
1019 DRTO=0:CIRCLE=0
1020 GET #1,A
1025 IF A<48 THEN 1020
1030 IF A>57 THEN 1020
1040 IF A=49 THEN DRAW=1:GOTO 2000
1050 IF A=53 THEN FILL=1:GOTO 2200
1055 IF A=51 THEN ERASE=1:GOTO 2100
1060 IF A=52 THEN CIRCLE=1:GOTO 2150
1065 IF A=50 THEN DRTO=1:GOTO 2050
1070 IF A=54 THEN 3000
1075 IF A=55 THEN 3500
1080 IF A=56 THEN 4000
1085 IF A=57 THEN 10000
1090 IF A=48 THEN 10500
2000 ? "}"
2005 ? "PRESS BUTTON TO PLOT,HOLD BUTTON
 TO    DRAW,HIT ANY KEY TO RETURN"
2010 GOTO 200
2050 ? "}"
2055 ? "HIT ANY KEY TO ESTABLISH POINTS"
2060 GOTO 200
2100 ? "}"
2105 ? "HOLD BUTTON TO ERASE,HIT ANY KEY
 TO   RETURN"
2110 GOTO 200
2150 ? "}"
2155 ? "HIT ANY KEY TO ESTABLISH CENTRE
AND   RADIUS(LEFT-RIGHT)"
2160 GOTO 200
2200 ? "}"
2205 ? "HIT ANY KEY TO FILL AN ENCLOSED
SPACE"
2210 GOTO 200
2500 IF ERASE=1 THEN COLOR B:PLOT X,Y:GO
TO 1000
2505 IF DRAW=1 THEN COLOR B:PLOT X,Y:GOT
```

```
0 1000
2510 IF FILL=1 THEN COLOR 0:PLOT X,Y:GOT
0 400
2515 IF DRTO=1 THEN 900
2520 IF CIRCLE=1 THEN 600
2999 REM SCREEN COLOURS
3000 ? ")"
3005 ? "GREY(0),BLUE(1),ORANGE(2),GREEN(
3),   PINK(4),PURPLE(5)?";
3010 GET #1,SET
3011 IF SET<48 THEN 3010
3012 IF SET>53 THEN 3010
3015 IF SET=49 THEN SET=8
3020 IF SET=51 THEN SET=13
3030 SETCOLOR 4,SET,8
3035 GOTO 1000
3499 REM PLOT COLOUR
3500 ? ")"
3505 ? C1$;"(1),";C2$;"(2),";C3$;"(3)?"
3525 GET #1,A:C=A-48
3530 IF C<1 OR C>3 THEN 3525
3535 GOTO 1000
3999 REM PALETTE COLOURS
4000 ? ")"
4005 ? "WHITE(0),BLACK(1),BLUE(2),GREEN(
3),   YELLOW(4),RED(5),ORANGE(6),BROWN(7
)   PICK 3";
4015 FOR K=1 TO 3
4020 GET #1,A:A=A-48
4025 IF A<0 OR A>7 THEN 4020
4030 IF A=0 THEN A$="WHITE":R(K,1)=9:R(K
,2)=14
4035 IF A=1 THEN A$="BLACK":R(K,1)=0:R(K
,2)=0
4040 IF A=2 THEN A$="BLUE":R(K,1)=7:R(K,
2)=6
4045 IF A=3 THEN A$="GREEN":R(K,1)=13:R(
K,2)=10
4050 IF A=4 THEN A$="YELLOW":R(K,1)=15:R
(K,2)=12
4055 IF A=5 THEN A$="RED":R(K,1)=3:R(K,2
)=4
4060 IF A=6 THEN A$="ORANGE":R(K,1)=2:R(
K,2)=8
4065 IF A=7 THEN A$="BROWN":R(K,1)=2:R(K
,2)=2
4071 ON K GOSUB 4600,4700,4800
4075 NEXT K
4080 GOTO 1000
4600 C1$=A$:RETURN
4700 C2$=A$:RETURN
4800 C3$=A$:RETURN
9999 REM SAVE ROUTINE
10000 ? ")":? "PREPARE CASSETTE FOR SAVE
"
10005 SCREEN=PEEK(88)+256*PEEK(89)
10010 OPEN #2,8,0,"C:"
10015 FOR T=0 TO 3199
10020 PUT #2,PEEK(SCREEN+T)
10025 NEXT T
10030 PUT #2,SET
10035 FOR T=1 TO 3
10040 PUT #2,R(T,1):PUT #2,R(T,2)
10045 NEXT T
10050 CLOSE #2
10055 GOTO 1000
10499 REM LOAD ROUTINE
10500 ? ")":? "PREPARE CASSETTE FOR LOAD
"
10505 SCREEN=PEEK(88)+256*PEEK(89)
10510 OPEN #2,4,0,"C:"
10515 FOR T=0 TO 3199
10520 GET #2,A:POKE SCREEN+T,A
10525 NEXT T
10530 GET #2,SET
10535 FOR T=1 TO 3
10540 GET #2,A:R(T,1)=A:GET #2,A:R(T,2)=
A
10545 NEXT T
10550 CLOSE #2
10551 SETCOLOR 4,SET,6
10555 GOTO 1000
10999 REM PROTECT TEXT WINDOW
11000 DIM DL$(29)
11010 RESTORE 11050:FOR X=0 TO 28:READ I
:POKE ADR(DL$)+X,I:NEXT X
11020 POKE PEEK(560)+256*PEEK(561)+84,14
1
11030 POKE 513,INT(ADR(DL$)/256):POKE 5
12,ADR(DL$)-PEEK(513)*256
11040 RETURN
11050 DATA 72,169,0,141,10,212,141,27,20
8,169,144,69,79,37
11060 DATA 78,141,24,208,169,10,69,79,37
,78,141,23,208,104,64
```

McConverter

Ed Corteen,
Westbury,
Wiltshire.

Spectrum

THIS PROGRAM is designed to convert machine code into data statements which are then ready for publication. I have used the method used by Ian Briscoe in his Windos program.

To use the program simply type it into your Spectrum altering the program to suite. The addition of the interface 1 and Microdrives alters the base address of Basic so use Let Poke =23761 for non-Microdrive users and LET Poke =23819 if the Microdrives are fitted.

The program as listed is self-explanatory. Run the program and you will be presented with the Menu. If your program is a long one it is probably best if you use option 3 first to ensure you don't run out of memory when using Edit to enter copies of line 1000.

Once the program has been run always use Goto g to run. Now use option 1 to initialise the variables. Use Edit to enter copies of line 1000. Use a line interval of 10.

Next use option 2 to check that you have entered enough copies.

Now we come to the interesting part. If you look in the manual page 166, you will see how the lines of Basic are organised. We know the address and length of each line — 119 bytes. Option 4 will read the machine code, convert it to Hex notation and Poke the code into each line. At the same time it calculates the checksum and this is Poked in at the end of the line. Using Edit to enter copies of line 1000 reserves space at the correct address for your machine code.

This process is quite slow being Basic. It takes about 40 seconds per line. Clever machine-code programmers can convert this.

Once the code has been Poked into each line it can be checked with option 5. To publish your masterpiece simply send off the data lines with the loader program (lines 7200 to 7630) plus any extra Basic lines required. And there you have it — all the hours spent coverting and checking your code have been overcome.

The data lines once "decompiled" can now be anywhere in your completed program. But remember they must be at the beginning of your program while they are being converted. If they aren't you will end up with some very strange looking lines or more likely a crash!

```
1000 DATA "0000000000000000000000
0000000000000000000000000000000000
0000000000000000000000000000000000
0000000000000000000000000000000000
00000000000000000",1234
1010 DATA "0000000000000000000000
0000000000000000000000000000000000
0000000000000000000000000000000000
0000000000000000000000000000000000
00000000000000000",1234
1020 REM use 100 characters per
line, with 4 characters for chec
ksum
1030 REM use line interval of 10
 for data statements
6000 REM AUTOLINE
6010 REM ED CORTEEN
6020 REM January 1985
6990 REM after running program
use GO TO g to run
7000 LET g=7000: CLS : PRINT "En
ter....."
7010 PRINT "1:To initialise"
7020 PRINT "2:To check number of
 DATA lines"
7030 PRINT "3:To load m/c code"
7040 PRINT "4:To Decompile progr
am"
7045 PRINT "5:To compile program
"
7050 IF INKEY$="" THEN  GO TO 70
50
7060 IF INKEY$="1" THEN  GO TO 8
000
7070 IF INKEY$="2" THEN  GO TO 8
055
7080 IF INKEY$="3" THEN  GO TO 8
500
7090 IF INKEY$="4" THEN  GO TO 8
100
7100 IF INKEY$="5" THEN  GO TO 7
200
7110 GO TO 7050
7195 REM **hex loader**
7197 REM change address as neede
d
7200 CLEAR 58999
7210 LET address=59000
7220 LET line=1000: RESTORE line
7230 FOR a=1 TO line:
  REM **number of DATA lines**
7240 GO SUB 7500
7245 PRINT line;" OK.";
7250 LET line=line+10
7260 NEXT a
7270 CLS : PRINT "Code in memory
-"
7280 INPUT "name of code? ";z$:
INPUT "length of code? ";length
7290 SAVE *"m";1;z$CODE address,
length
7300 PRINT "Verifying..": VERIFY
 *"m";1;z$CODE
7310 PRINT "Finished saving ";z$
7320 GO TO 7000
7500 READ a$,checksum
7510 LET total=0
7520 FOR i=1 TO LEN a$ STEP 2
7530 LET high=CODE a$(i)-48
7540 LET low=CODE a$(i+1)-48
7550 LET high=high-39*(high>9)
7560 LET low=low-39*(low>9)
7570 LET byte=(16*high)+low
7580 LET total=total+byte
7590 POKE address,byte
7600 LET address=address+1
7610 NEXT i
7620 IF total<>checksum THEN  PR
INT "Error in line ";line;"."'"c
heck and re-run": STOP
7630 RETURN
7990 REM **initialise**
8000 CLS : PRINT "enter lenth of
 m/c CODE ": PRINT "this must be
 rounded UP to the  nearest 50":
 INPUT l
8005 LET s=INT (l/50): REM numbe
r of lines required
8010 PRINT "use EDIT to create "
;s;" copies       of line 1000"
```

(continued on next page)

(continued from previous page)

```
8015 PRINT#0;"press any key to
LIST program": PAUSE 0
8020 CLS : LIST 1000
8040 REM **check number of data
lines**
8050 REM *detects the quote mark
after each data statement**
8053 REM if no microdrive fitted
 LET poke=23761
8055 LET poke=23819: LET line=0
8065 FOR p=poke TO poke+(x+1)*11
9 STEP 119: IF PEEK (p-1)<>34 TH
EN  GO TO 8080
8070 LET line=line+1: NEXT p
8080 PRINT AT 8,0;"you have ente
red ";line ;" codes in your line 100
0"
8090 GO TO 7050
8095 REM **decompiling routine**
8100 LET poke=23819: INPUT "star
t of code? ";peek
8110 LET linenumber=990
8115 FOR p=poke TO poke+((x-1)*1
19) STEP 119
8120 LET linenumber=linenumber+1
0: PRINT AT 10,0;"decompiling li
ne ";linenumber
8130 GO SUB 9000
8140 NEXT p
8150 PRINT AT 12,0;"FINISHED!"
8155 PRINT#0;"Hit any key to co
ntinue": PAUSE 0
8160 GO TO 7000
8490 REM **loading routine**
8500 IF poke=23819 THEN  GO TO 8
550
8510 PRINT#0;"prepare cassette
and hit any key": PAUSE 0
8520 LOAD ""CODE
8530 GO TO 7000
8550 CAT 1: INPUT "name of CODE
?";z$
8560 LOAD *"m";1;z$CODE
8570 GO TO 7000
9000 DIM a$(2): LET checksum=0
9010 LET a=p
9030 FOR a=a TO a+99 STEP 2
9040 LET a$=FN h$(PEEK peek)
9050 LET checksum=checksum+PEEK
peek
9060 LET peek=peek+1
9070 POKE a,CODE a$(1)
9080 POKE a+1,CODE a$(2)
9090 NEXT a
9100 DIM c$(4): LET c$=STR$ chec
ksum
9110 FOR f=2 TO 5: POKE a+f,CODE
 c$(f-1): NEXT f
9120 RETURN
9960 REM ***dec-hex converter***
9970 DEF FN k$(x,y)="0123456789a
bcdef"(INT (x/16^y)-16*INT (x/16
^(y+1)))+1)
9980 DEF FN h$(x)=FN k$(x,1)+FN
k$(x,0)
9998 ERASE
9999 SAVE *"m";1;"autoline"
9999 SAVE *"m";1;"autoline": VER
IFY *"M";1;"autoline"
```

Hires and Gnasher

Karl Williams,
Swansea,
West Glamorgan.

HIRES COPY provides a direct screen to printer dumping utility which handles text and graphics on all Oric computers except the 16K machine for which the addresses in lines 10020, 10050, 10060 and 11010 must be altered.

Oric Gnasher is a Pac-man style program following the usual rules and is designed for use on the Atmos although it should run on the Oric-I 48K.

Cursor keys are used to guide your man around the maze. However, points are lost if you retrace your steps which is also dangerous as the ghost follows in your footsteps and gets closer towards the end of the game, the maze has been designed with this in mind.

Moving over the fruit enables you to kill the ghost before the screen returns to normal. The object is to eat all the dots and move onto the pyramid. More screens could be added by using more data after lines 2120 to 2180 with appropriate adjustments in the rest of the program.

Hire copy.

```
10015 LPRINT CHR#(1B);LPRINT"I"
10020 A=EA000
10030 REPEAT
10040 A=A+1
10050 UNTIL PEEK(A)>64 OR A=EBF3F
10060 IF A=EBF3F THEN LPRINT"M0,-400":PING:END
10070 X=PEEK(A)-64
10080 IF X/32>=1 THEN X=X-32:S=1:GOSUB 11000
10090 IF X/16>=1 THEN X=X-16:S=2:GOSUB 11000
10100 IF X/8>=1 THEN X=X-8:S=3:GOSUB 11000
10110 IF X/4>=1 THEN X=X-4:S=4:GOSUB 11000
10120 IF X/2>=1 THEN X=X-2:S=5:GOSUB 11000
10130 IF X/1>=1 THEN S=6:GOSUB 11000
10140 GOTO 10030
11000 REM *PRINTER*
11010 B=A-EA000
11020 CY=INT(B/40)
11030 CX=(((B-CY*40)*6)+S)*2
11035 CY=CY*-2
11040 LPRINT"M";CX;","+CY;LPRINT"D";CX+1;","CY
11050 LPRINT"M";CX;","CY-1:LPRINT"D";CX+1;","CY-1
11060 RETURN
```

Gnasher.

```
0 CLS:PAPER 0:INK 1
1 DIM M1(800),N1(800):C$="2580"+S?;H$="Karl Williams
":H1=2500
2 PRINT CHR#(4),CHR#(20),CHR#(17)
3 GOSUB 5000
4 CLS
10 GOSUB 1000
20 GOSUB 2000
25 GOSUB 3000
30 X=21+RND:Y=1+26
35 EXPLODE
40 FOR K=LEV TO 1 STEP -1
42 V=42+4*K:W=4*K:AW=175
43 IF X/2-INT(X/2) THEN W=41+W:AV=174:AW=47
50 A=DEEK(76D)
52 M1(X)=A:N1(X)=D:D=1
53 IF D=8 THEN GOSUB 4000
54 IF D>0 THEN PAPER2:INK4:V=41:W=43:WAIT 10 ELSE PAP
ER 0
55 IF A=65160 THEN L=DERN1X,Y:GOTO 130
70 IF A=48051 THEN X=X+1:GOTO 110
80 IF A=48255 THEN X=X+1:GOTO 110
90 IF A=48119 THEN Y=Y+1:GOTO 110
100 IF A=48375 THEN Y=Y-1
110 L=DERN1X,Y
115 IF L=48 THEN X=M1(X):Y=N1(X):GOTO 145
120 IF L=45 THEN P=P+1B:D=D+1:GOTO 140
125 IF L=32 THEN P=P-5:GOTO 140
130 IF L=43 OR L=44 OR L=46 OR L=47 OR L=48 THEN 210
135 IF S<1 THEN R=555:GOTO 4000
140 PLOT M1(X),N1(X),32:PLOT X,Y,V
145 IF K.LEV-LEV#.B7 THEN 155
150 W=W+AV:S1=S1+PLOT X,E,32:PLOT M1(X),N1(X),W:D=M1(X)
:E=N1(X)
155 PLOT 21,9,AW:PLOT AX,AV,AV
160 GOSUB 1,X*2,AW:PLOT 1,8,A,1000
170 PRINTB 16,0;A:PRINTB 31,0;B
180 PRINTB 18,1;INT(P/(A-VAL(A#)/2)):PRINTB21,1;INT
(P/10):PRINTB 31,1;C#
185 IF S<1 THEN R=555:GOTO 4000
190 NEXT K
200 R=777:GOTO 4000
210 A=9810
230 IF L=48 OR L=174 THEN FING:P=P+25B:PD=PD+1:D=25:G
OSUB 3000:GOTO 135
240 IF L=47 OR L=175 THEN 280
250 IF L=43 OR L=44: AND D<B THEN 270
260 PLOT X,Y,V:FINDLEN 1:FOR D = 1 STEP -1:SOUND 1,M,1
5:NEXT H:P=P+500
265 IF D=B+1:D=1:GOTO 140
270 PLOT M1(X),N1(X),32:FOR H=1 TO 300:SOUND 1,M,D:PLAY
1,1,2,5:NEXT H
275 P=P-300:S=S-1:GOTO 150
280 IF Q<1397-PD THEN 290 ELSE 310
290 PLOT X,Y,V:PLOT M1(X),N1(X),32:FOR H=B0 TO 300 STEP
1:PAPER H/40
300 SOUND 1,350-H,15:NEXT H:P=P+1000:R=111:GOTO 4000
310 SHOT:S=S-1:GOTO 150
320 SOUND 1,AND(1)+1000+1,15:PAPER 1:PLAY 0,0,0,1:GOT
O 4000
330 SHOT:S=S-1:GOTO 150
1000 REM REDEFINE CHARACTERS
1010 FOR A=A#400 TO A#63
1020 READ D:POKE A,D
1030 NEXT A
1040 RETURN
1050 DATA 12,12,30,51,51,30,12,12,30,63,45,45,63,33,6
0,30,30,63,45,45,63,33,51,60
1060 DATA 30,14,21,31,31,27,17,17,17,14,31,21,31,31,3
1,31,31,0,0,0,12,12,0,0,0
1070 DATA 6,0,12,30,63,63,30,12,0,0,12,12,30,63,0
2000 REM SET UP SCREEN
2005 CLS:PAPER 0
2010 PRINT CHR#(12S):PRINT CHR#(13S)
2015 GOSUB 4000
2020 PLOT 9,0,"LEVEL:"+PLOT 24,0,"LIVES"
2025 PLOT5,1,"POINTS"+PLOT16,1,"TIME"+PLOT25,1,"HIS
CORE"
2030 FOR C=1 TO 55
2040 IF C=1 THEN D=48 ELSE D=1
2050 READ E,F
2060 FOR D=D TO D+E:POKE A+D,F:NEXT D
C
2070 FOR H=48162 TO 48999:IF PEEK(H)=32 THEN POKE H,4
5
2080 NEXT H
2090 FOR I=48162 TO 49082 STEP 40:POKE I,32:NEXT I
2100 FOR I=48039 TO 49039 STEP 40:POKE I,32:NEXT I
2120 DATA 83,118,165,178,172,189,191,196,247,256,258,
268,262,274,327,334
2130 DATA 489,416,458,459,463,465,491,499,542,544,571
,579,623,625,649,651
2140 DATA 781,782,784,785,729,730,744,754,769,778,887
,888,812,818,824,830
2150 DATA 853,854,858,858,885,890,894,900,982,987,911
,916,963,968,993,998
2160 DATA 123,923,285,485,565,645,567,767,449,689,852
,892,296,376,298,338
2170 DATA 619,699,798,868,421,661,782,862,384,344,346
,466,388,468,869,989
2180 DATA 358,718,791,871,312,672,354,714,236,516,096
,076,196,556
2200 RESTORE:RETURN
3000 FOR G=0TO
3005 B=INT(RND(1)*5)+11:IF B=1 THEN A#=33:A#=21
3010 IF B=2 THEN A#=24:A#=21
3020 IF B=3 THEN A#=18:A#=21
3030 IF A#=# AND A#=0 THEN 3005
3040 IF D=25 THEN PRINTB 2,0;CHR#(12S):PRINT CHR#(12S
)
3050 RETURN
4000 WAIT 300:CLS:PAPER 0:INK 4
4005 PING
4010 IF R=111 THEN G#="CONGRATULATIONS"
4020 IF R=777 THEN G#="Sorry you ran out of time!"
4030 IF R=555 THEN G#="Sorry you ran out of lives!"
4040 FOR H=1TO LEN(G#):V=2
4045 PRINT:PRINT CHR#(4)
4050 PRINT:PRINT CHR#(27);"D";CHR#(27);"H";SPC(39);G#
4055 PRINT:CHR#(4)
4060 PRINT:PRINT"LEVELS";TAB(18);CHR#(135);LE
4070 PRINT:PRINT"GHOSTS";TAB(18);CHR#(135);E
N
4080 PRINT:PRINT"FRUIT";TAB(18);CHR#(135);FR
UIT
4090 PRINT:PRINT"LIVES LOST";CHR#(135);TAB(18);LS
4100 PRINT:PRINT:CHR#(27);"B  You scored";INT(P/4-V
AL(A#))" points"
4110 IF P/4-VAL(A#)>H1 THEN 4140
4130 PRINT:PRINT CHR#(135);CHR#(148);"You have beaten
 the previous HISCORE!"
4135 PRINT CHR#(135);CHR#(148);"of ";H1;" points by ";
P/4-
4138 C#=STR#(P):PRINT:INPUT" Your NAME?";H$:H1=P
4140 PRINT:PRINT"Again? Y or N";REPEAT:GET X$:UNTIL X
$="y" OR X$="n"
4150 IF X$="y" THEN 4180
4160 PRINT CHR#(4),CHR#(27),CHR#(20)
4170 CLS:PAPER 4:INK 7:PING:WAIT 500
4180 PRINT:PRINT"Enter level (1 or 3)";CHR#(135);
4185 REPEAT:GET H$:UNTIL VAL(H$)=0 AND VAL(H$)<4:PING
:PRINT A#
4190 LEV=14-VAL(H$)*2:V=48
4195 S=1:P=0:PD=0:LS=0:D=0:G=0:GOTO 10
5000 CLS:PAPER 0:INK 2
5010 PRINT CHR#(4)
5020 PRINT CHR#(27);"D";CHR#(27);"N"  ORIC GNA
SHER"
5025 PRINT CHR#(4)
5030 PRINT:PRINT:PRINT"Use Cursor keys to guide yours
elf"
5040 PRINT:PRINT"through the maze but beware of Bolin
x"
5050 PRINT:PRINT"the Gaelic Ghost! He can only be "
5060 PRINT:PRINT"destroyed in the short time after yo
u"
5070 PRINT:PRINT"have eaten the fruit found somewhere
"
5080 PRINT:PRINT"in the maze."
5085 PRINT:PRINT"  Your final objective being to ge
t"
5087 PRINT:PRINT"to the flashing pyramid after eating
"
5088 PRINT:PRINT"all the dots!":PRINT
5090 PRINT:PRINT:CHR#(133);"Enter level 1,2 or 3";C
HR#(135);
5092 REPEAT:A#=KEY:SOUND1,RND(1)*300,12:WAIT20:UNTIL
VAL(A#)>0 AND VAL(A#)<4
5094 PRINT:VAL(A#):LEV=(4-VAL(A#))*75+400
5095 PRINT:PRINT CHR#(132);CHR#(148);SPC(5);"Press 'R
ETURN' to start"
5100 REPEAT:SOUND 1,RND(1)*300,12:WAIT 15:UNTIL KEY$=
CHR#(13)
5110 PING:RETURN
6000 FOR D4 TO 26:PRINTB 1,D;CHR#(INT(RND(1)*5)+12)
6010 NEXT D
6020 PRINTB 2,0;CHR#(135):PRINT CHR#(13S)
6030 RETURN
```

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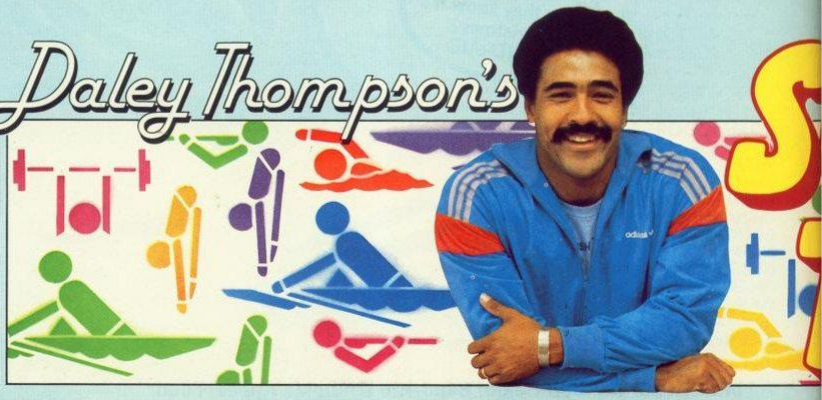

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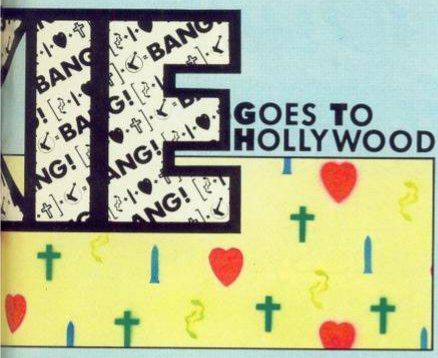

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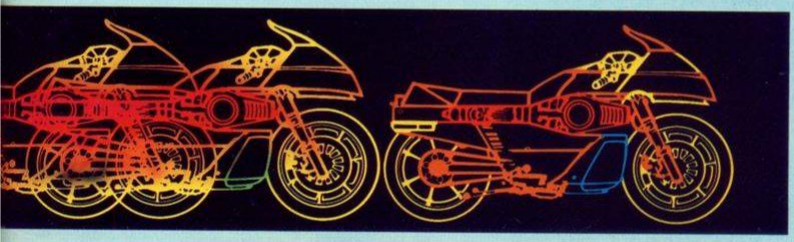

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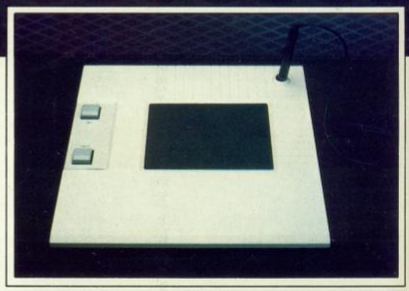

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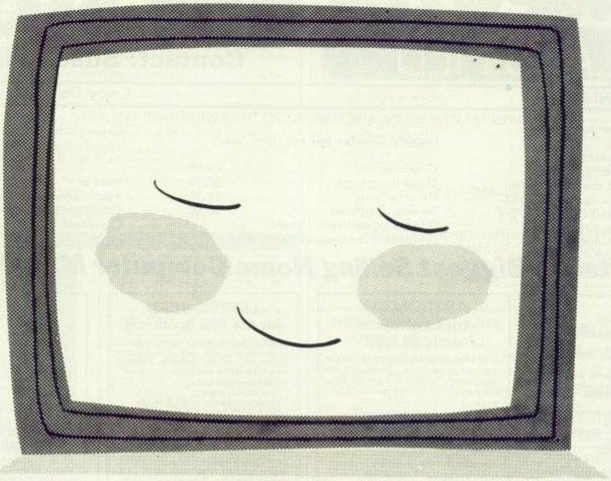

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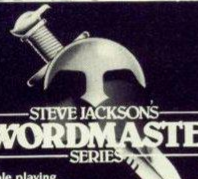

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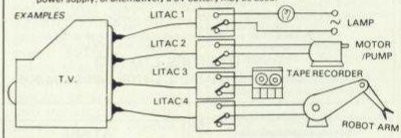

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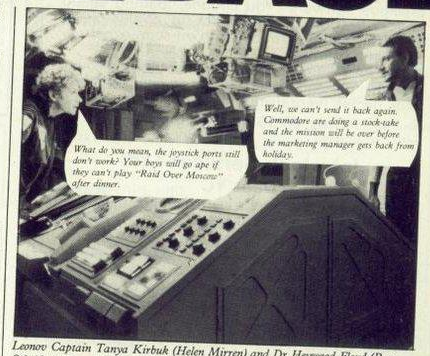

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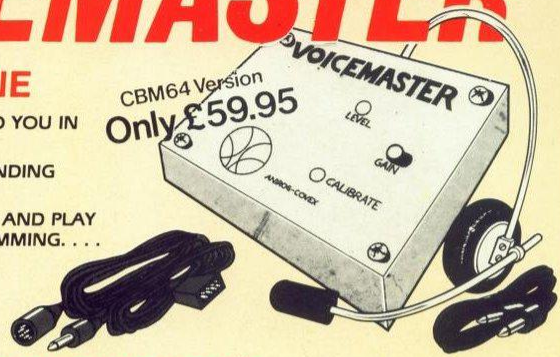

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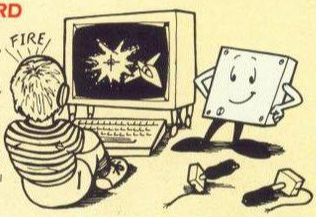

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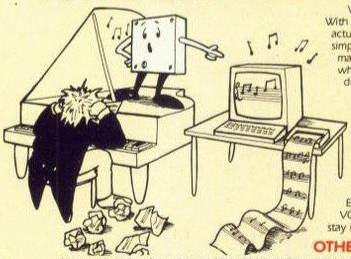

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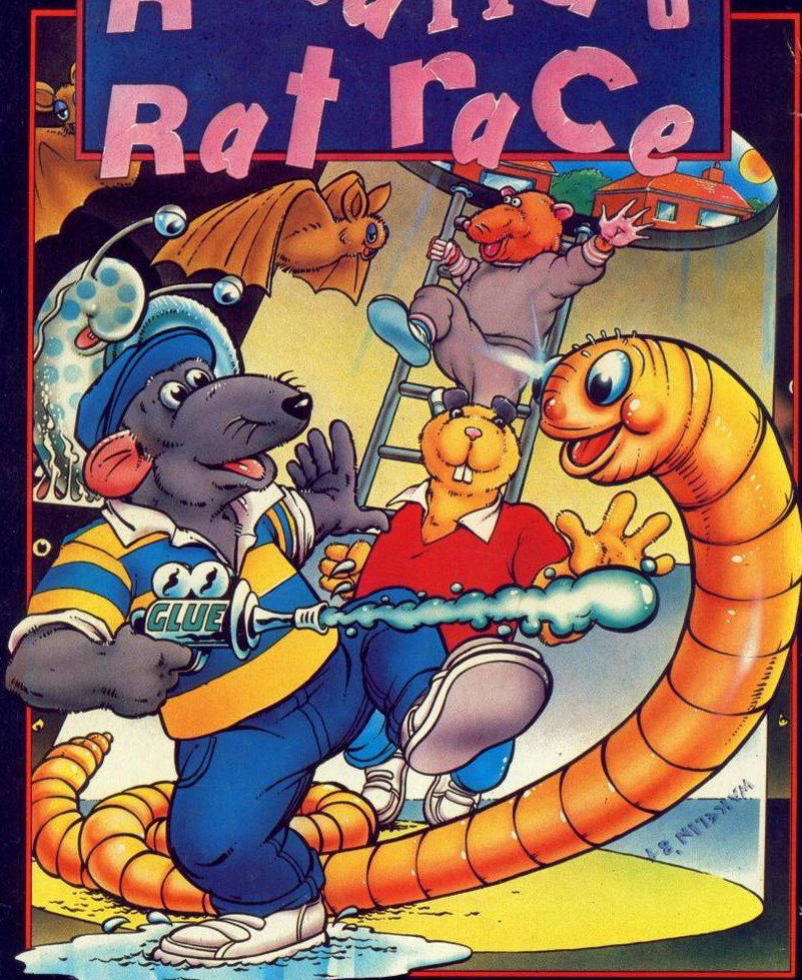

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